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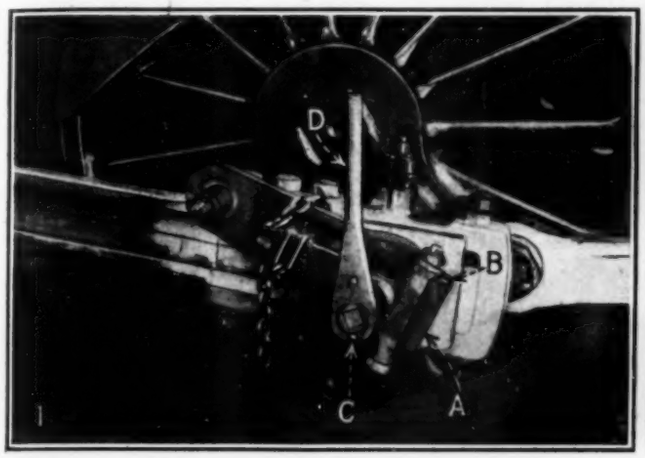

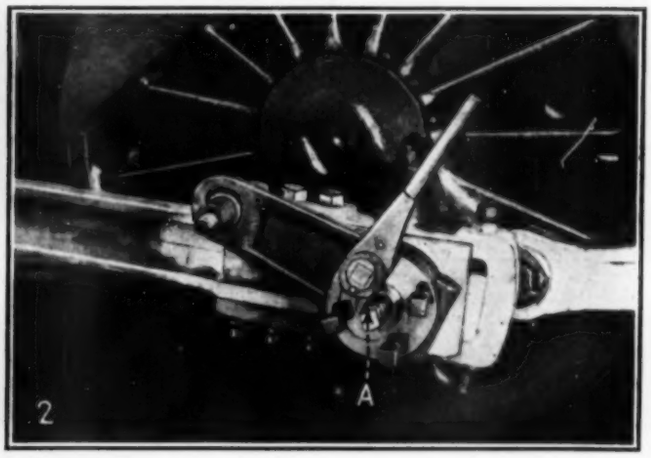

Fig. 1—Removing an eccentric crank. *Fig. 2—Replacing an eccentric crank*

Motion Work on the L. V. R. R.

By S. Ashton Hand
Associate Editor, American Machinist

THE valve gear or motion work of a locomotive is the heart of the machine and upon its correct functioning depends both the efficiency and the comparative expense of operation. Therefore, in overhauling a locomotive someone must know whether or not each member of the system has been properly machined, either in the repair shop or in the shop of the builder, for parts are not always right when the engine leaves the hands of the maker. In stripping and re-assembling the motion parts, one of the troublesome jobs is the removal and replacement of the eccentric cranks of the Walschaert and Baker valve gears. In many shops this job is done by the use of sledge hammers, blocks and wedges, but in the Lehigh Valley Shop at Sayre, Pa., the special equipment shown in Figs. 1 and 2 has been provided.

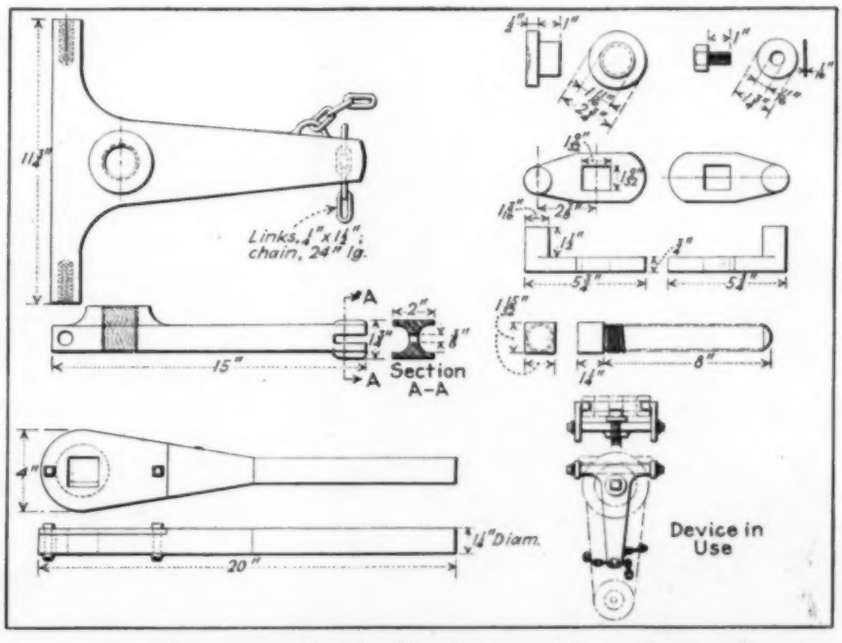

Fig. 3—Details of puller for eccentric cranks

For removing the crank, the puller *A* is attached as shown in Fig. 1. Removable ears having fingers that enter both ends of the hole for the clamping bolt, are held on square projections of the device by capscrews, as at *B*. A chain, fastened to an eye in the puller is passed around the crank and holds the tail of the puller to it. The square-headed screw *C*, threaded in the puller, bears against a thrust block placed against the end of the crankpin. With the ratchet wrench *D* placed on the screw *C*, it is an easy matter to remove the crank from

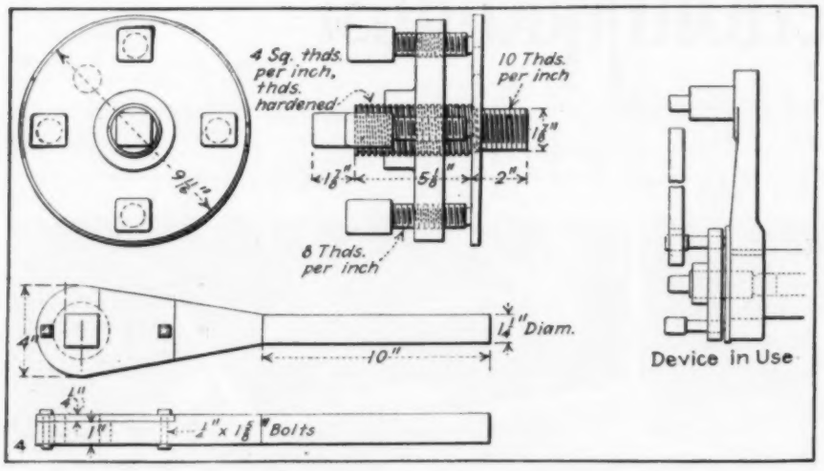

Fig. 4—Details of device used for replacing eccentric cranks. Usually the cranks are driven on to the crankpins by a sledge. Cranks that are replaced by such a method will get badly battered after several removals and replacements. Also there is danger of spoiling the hole or the pin, or both. By using the device illustrated, the cranks can be replaced without damage

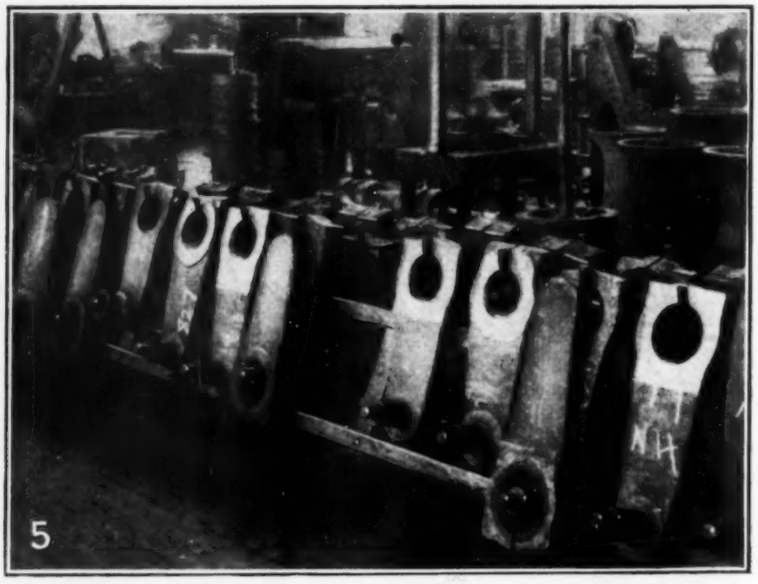

Fig. 5—Rack for eccentric cranks. Where many engines are undergoing repairs at the same time, parts of each engine must be kept separate. Especially is this true of eccentric cranks, for getting them mixed would entail serious trouble in "squaring up," or setting the valves. To overcome any such difficulty, the rack illustrated was built. As each engine is dismantled, its eccentric cranks are put together in the rack

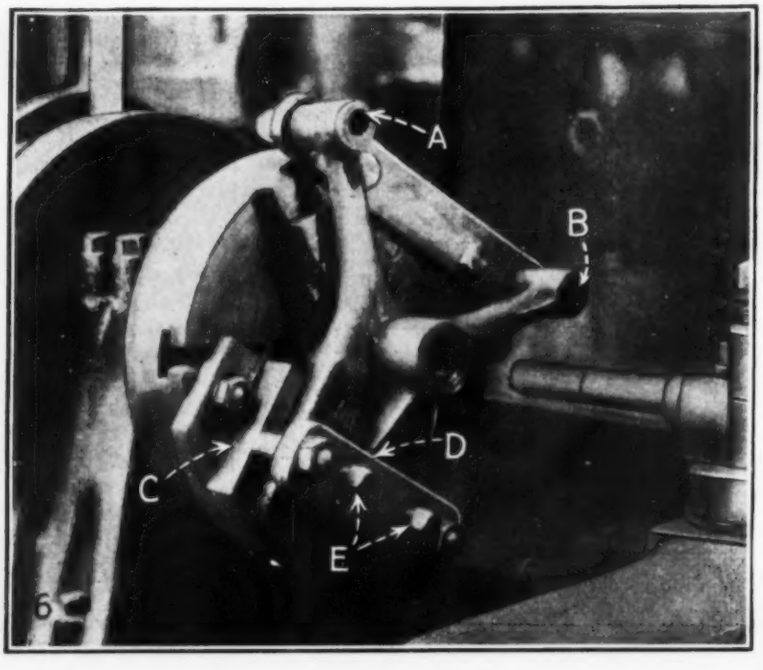

Fig. 6—Boring and reaming fixture for reconditioning hand-lever stands for Ragonnet reversing gear. So that the lever will function properly, it is necessary that the pivot hole be radially central with the bosses for the quadrant bolts. The pivot hole becomes worn in use and must be rebored and bushed. Sometimes this is a difficult matter, for it is not always that the hole has been accurately positioned by the maker

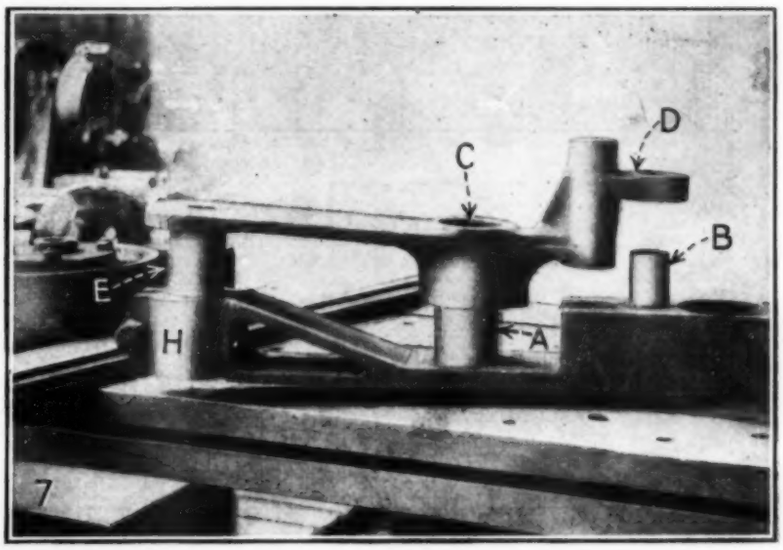

Fig. 7—Fixture for testing the accuracy of work on the reverse yokes of Baker valve gears. In repairing the yokes, the holes and pin must be in accurate relation to each other. In the case of the yoke being inspected, the work has not been done properly, since the pin E will not enter its mating hole in the fixture

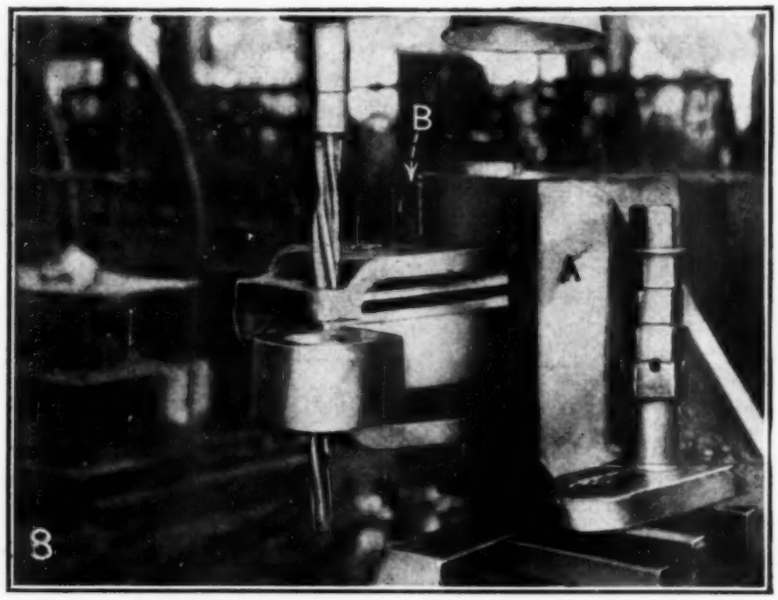

Fig. 8—Drilling and reaming fixture for Walschaert links and link trunnions. In assembling Walschaert links, the bolt holes must come "fair" in all the parts. In the fixture illustrated, the trunnion bosses are held in V-blocks at the top and bottom, respectively, of the angle plate A, and are clamped therein by caps. After one hole has been drilled and reamed, a tight-fitting pin is put through all the parts, holding them in place while the other holes are being drilled and reamed

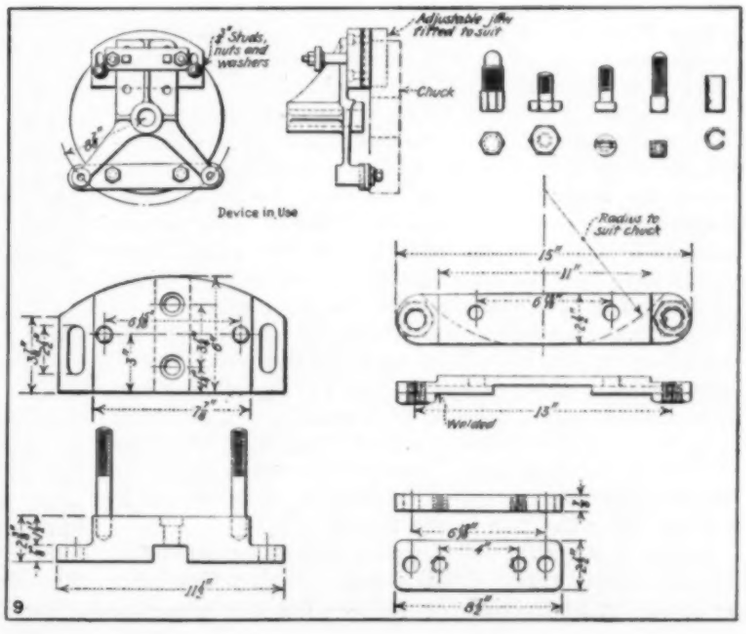

Fig. 9—Details of the boring fixture for the hand-lever stand of the Ragonnet reversing gear. As explained in connection with Fig. 6, it is necessary that the pivot hole for the lever shall be accurately located in relation to the bolt holes for attaching the quadrant. As can be seen by the drawing, the fixture consists of various parts attached to an ordinary lathe chuck. When the stand is mounted in the fixture, as shown by the small sketch in the upper left-hand corner, the proper location of the pivot hole is in axial line with the lathe spindle

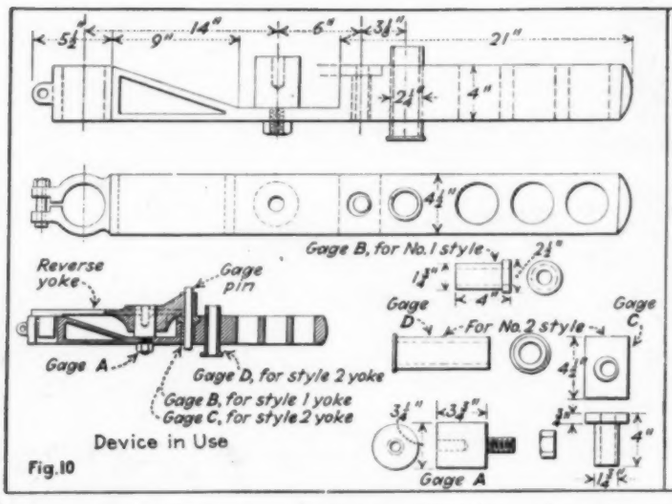

Fig. 10

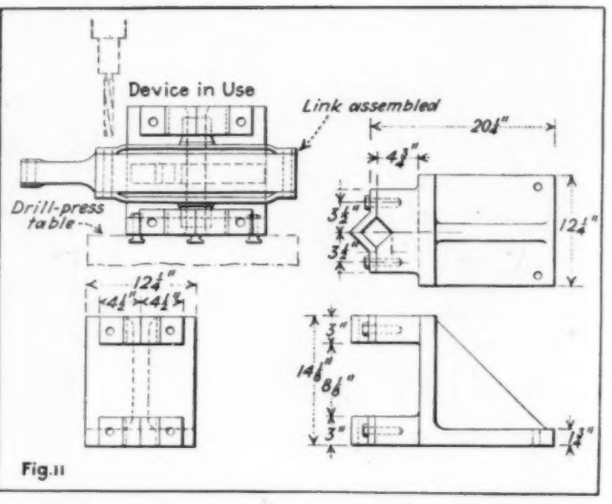

Fig. 11

Fig. 10—Details of testing fixture for yokes of Baker reversing gear. Fig. 11—Details of fixtures for drilling and reaming Walschaert links and link trunnions

the pin. The thrust block is of two diameters, the smaller part entering the tapped hole in the pin, while the shoulder bears against the end.

For replacing the crank, the device shown in Fig. 2 is used. The central screw *A* is engaged in the tapped hole of the hollow crankpin and holds the device in place. The four square-head screws, equidistantly spaced near the periphery, bear on the hub of the crank. With the ratchet wrench to be seen on one of these screws, and placed on all of them alternately, it is a simple matter to force on the crank evenly and to avoid any cocking or binding on the crankpin. In Figs. 3 and 4 the details of the devices for pulling off and replacing the eccentric cranks, are given.

After removal of the eccentric cranks they are placed in the rack shown in Fig. 5, the cranks for each engine being kept together. By this means, the pair for each engine can easily be located when wanted either for repair or for assembly.

In repairing the hand-lever stand of the Ragonnet power-reversing gear, the pivot hole for the lever has to be rebored and bushed. The stand is an awkward piece to chuck so as to bring the center hole in the proper position for boring, so the special attachments to the chuck, shown in Fig. 6, have been made. The stand is mounted on studs at *A* and *B* and is clamped to the block *C* by the strap *D*, the screws *E* engaging slots in the casting. A fixture of this kind is a necessity, for even if the hole were in such condition as would permit its being trued with the stand in its original position, there would still be some doubt as to its correct location, relative to the holes in the two arms, since stands have been found where the center holes had not been bored in the proper position by the makers.

A fixture for testing the correctness of the machining after repairs have been made on reverse yokes of Baker valve gears is shown in Fig. 7. If the work has been properly done, the pins at *A* and *B* must enter the holes *C* and *D*, while the pin *E* on the yoke must enter the hole *H* in the fixture. The yoke shown in the illustration has not been properly machined, since the pin *E* will not enter the hole in the fixture.

In Fig. 8 is a fixture for holding Walschaert links and link trunnions while drilling and reaming the holes necessary in assembling the parts. The trunnion lugs are held in V-blocks attached to the angle plate *A* at the top and bottom, respectively, and are clamped by caps, the upper one of which can be seen at *B*. After the first hole through all the parts has been reamed, a tight fitting pin is put through it to hold them in position while the other holes are being drilled and reamed. Details of the fixtures shown in Figs. 6, 7 and 8 are given in Figs. 9, 10 and 11. In each instance the method of application is illustrated, so that in connection with the halftones they are understandable without further explanation.

Hard Jobs for the Shop

BY G. B. STUART

I WAS going through a French arsenal during the war and passed a mechanic planing up some 75mm. recuperator parts on an old chain planer of the vintage of about 1850.

"Do you think your American machinists could turn out work of that quality if they had this machine?" asked the old shop manager through our interpreter.

"No," I said, "Our American workman would say 'get that relic out of here and give me a new machine.' Then he would produce the goods in shorter time."

That is very nearly true of both workmen and shop executives in regard to equipment, but I wonder if we don't still fall down when it comes to co-operation between the designer and the shop in the average plant? My attention was called recently to a production shop sweating over an almost impossible situation in trying to produce accurately a cast-iron disk $\frac{1}{4}$ in. thick and 3 in. in diameter, containing eight radial slots $1\frac{1}{16}$ in. deep equally spaced and varying in width by 0.002 from 0.010 to 0.024 in. It was a job for an expert toolmaker, rather than for the production shop.

Why some designers of special machinery and apparatus launch their designs into production without consulting the shop foremen is a puzzle to me. The chances are 10 to 1 that the design could have been altered to adapt a simpler part, or the impractical cast iron could have been changed to steel. It would have been a "cinch" to stamp it out of thin sheet steel and spot weld together. The shop should have its kick in advance rather than after the designs are completed.

Some Common Misconceptions in Worm Gear Design

By H. L. Blood and D. V. Waters
Western Electric Co., Inc.

A better design is sometimes obtained if the addenda of the worm and the gear are unequal—Increase of pressure angle used to avoid undercutting—Simplified gear blank form

FOR a worm and worm gear designed in the conventional way as shown in Fig. 1, the center distance is equal to half the sum of the pitch diameters of the worm and gear. As a result, the center distance is usually in odd thousandths of an inch instead of in common fractions, and when a machine is designed to fit such a worm and gear, many dimensions must be expressed in thousandths, which are inconvenient for the shop as well as for the designer. Still greater difficulty is met in designing a worm and gear to replace another worm and gear having a different ratio. In a case of this kind the designer, after spending considerable time on the problem, often concludes that in order to make the center distance of the new gears exactly the same as that of the old ones it will be necessary to use an unsatisfactory ratio or to have a special hob made.

These difficulties are the result of two common assumptions; namely, that the addenda of a worm and worm gear must be equal, and that the pitch line of the gear must be tangent to the pitch line of the worm as shown in Fig. 1. Neither of these assumptions is correct. The idea that the addenda of a worm and worm gear must be equal arises from the fact that worm gearing is often shown in cross section, as in Fig. 2, where the shape of the teeth are similar to that of a spur gear and rack based on the Brown & Sharpe system, except that the worm teeth have straight sides while the teeth of the Brown & Sharpe rack are slightly curved to reduce undercutting of the pinions. However, while it is convenient in a system of interchangeable spur gears to keep the addendum the same for all gears of the same pitch, *it should not be assumed that this condition is necessary in the case of worm gears.* There are now in use a number of systems of spur gearing in which the addenda of two meshing gears are purposely made unequal in order to improve the

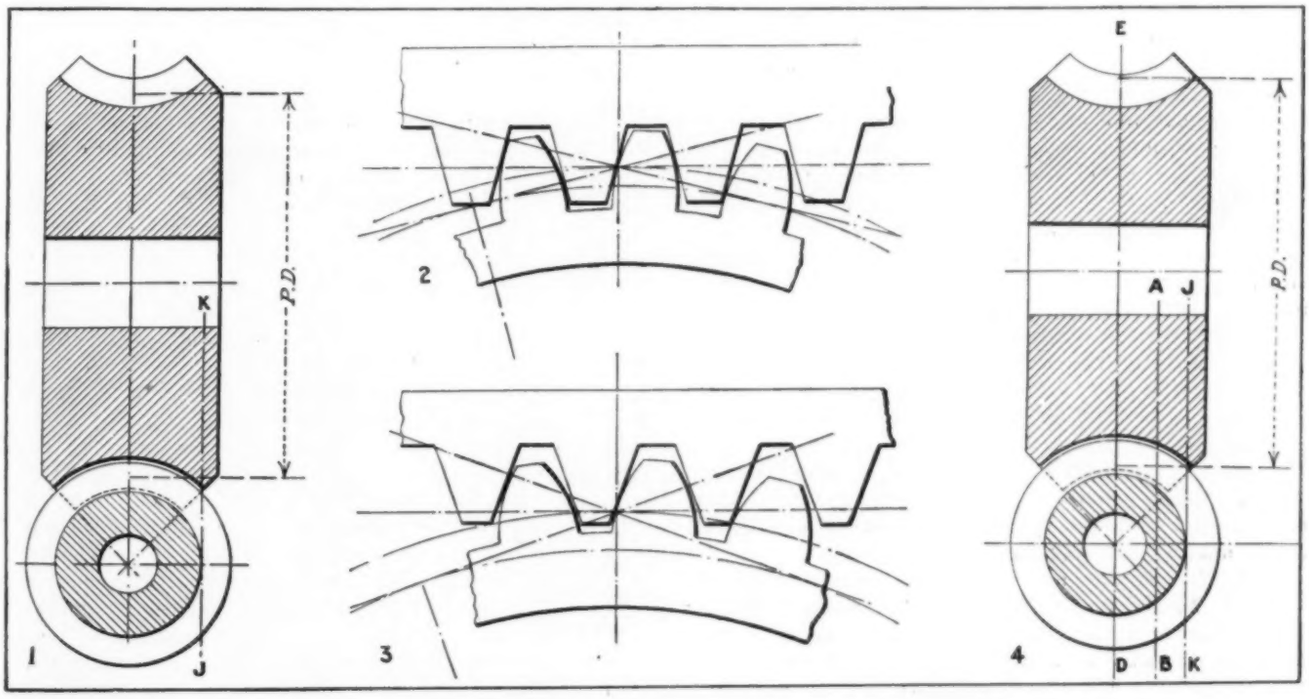

Fig. 1—Conventional worm and gear design. Fig. 2—Rack and gear of equal addenda. Fig. 3—Rack and gear of unequal addenda. Fig. 4—Worm and gear unit corresponding to Fig. 3

shape and action of the teeth, and the smaller of a pair of meshing gears generally is made with the larger addendum. A characteristic example of the tooth shapes obtained with such a system is shown in Fig. 3. A very convenient feature of these systems is that the center distances are not definitely fixed. Gears may be generated to run at any desired center distance within the limits of good tooth action. Similar results may be obtained in the case of worm gears; that is, the addendum of a worm gear may be increased by simply increasing the center distance between the hob and the gear during the hobbing process. This change will not prevent proper tooth action because the worm, being a counterpart of the hob, will mesh correctly with the gear at the increased center distance.

The pitch diameter of a gear meshing with a rack or worm may be defined as the diameter whose circumference is equal to the product of the number of teeth in the gear, and the linear pitch of the rack or worm. It is evident also, that the linear velocity of the rack or worm is equal to the velocity of the gear at this diameter. However, the axial linear velocity of a point on the teeth of a worm is the same at all diameters, and it should be clearly understood that a rack or worm taken alone has no pitch line. Only when it is meshed with a gear does the pitch line or plane, defined above, exist. The pitch line of the worm shown in Fig. 1 is misleading, therefore, and might better be omitted. If we consider the worm as a rack on which the gear rolls, the only pitch line we need consider is the one shown.

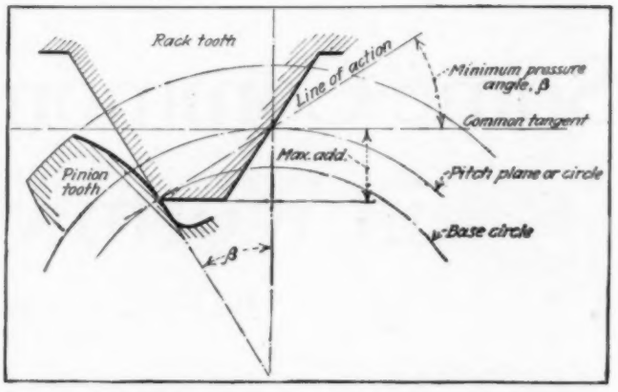

Fig. 5—Limit beyond which undercutting takes place

In Fig. 4 is shown a worm, identical with the one in Fig. 1 and meshing with a worm gear having the same number of teeth, but hobbed somewhat more deeply, thus reducing the center distance between the worm and the gear. The pitch diameter of the gear remains the same as in Fig. 1, since it is determined by the number of teeth and the pitch, neither of which has been changed. The pitch line of the worm has been omitted. It will be seen that in plane *DE* the pitch line of the gear is near the tip of the tooth. In plane *AB* it is in the center of the working face, and in plane *JK* it is near the base. None of these conditions is as extreme as in section *JK*, Fig. 1, in which the pitch line lies entirely outside the working surface.

When the number of teeth in the worm is small, the flanks of the teeth will be undercut unless a sufficiently high pressure angle is used. The relation existing between the number of teeth, the pressure angle, and the addendum of a gear meshing with a hob or rack is illustrated in Fig. 5. If undercut is to be avoided, the tops of the teeth of the hob or rack must not lie beyond the point at which the line or path of action ends or, in other words, becomes tangent to the base circle. Moreover, there is no tooth contact beyond this point.

In general, if the pressure angle is increased, the portion of the involute curve utilized for the contacting tooth faces has less curvature than portions lying nearer its origin. Since the curvature is less, it necessarily follows that a heavier load can be carried without rupture of the oil film, or abrasion, than would be the case if that portion of the curve having a greater curvature were used. The pressure angle recommended for general-purpose wormgears by most authorities is 20 deg. or more, but the pressure angle of many of the worm hobs now in existence is only 14½ degrees.

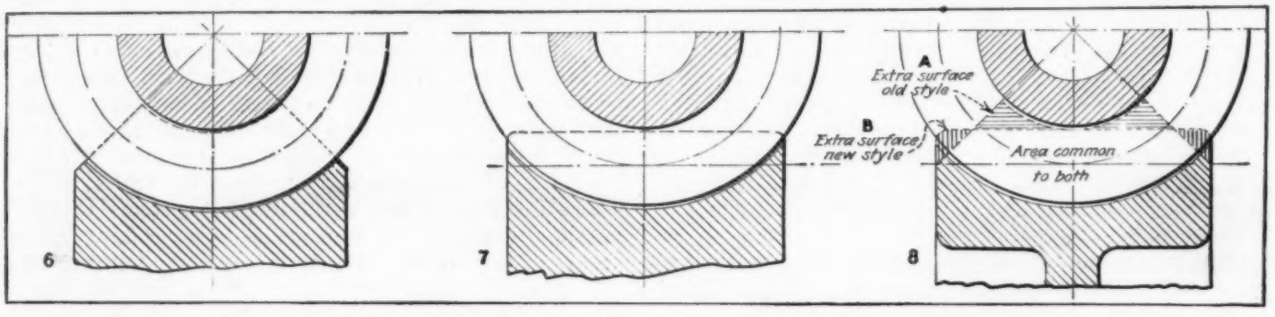

Fig. 6—Conventional gear blank form. Fig. 7—Simplified construction. Fig. 8—Comparison of the forms shown in Figs. 6 and 7

With a 14½ deg. pressure angle the undercutting will be similar to that occurring in the Brown & Sharpe system of spur gears, except that more of the working surface will be destroyed because the worm teeth are not rounded off like the teeth of a Brown & Sharpe rack to reduce undercutting. To minimize the undercutting when the gear has a small number of teeth, the flank, or portion of tooth inside the pitch line, should be kept short by designing the gear so that the center distance will be as great or even greater than shown in Fig. 1, and by using a hob with a high pressure angle.

It is customary to form the outside diameter of worm gears to the contour shown in Fig. 6. The calculation of the proper dimensions and the machining of the blanks are much more expensive than if the contour were as shown in Fig. 7. If the two shapes are superimposed as shown in Fig. 8, it will be evident at once that little or no tooth surface is lost if the simpler contour is used, and the surface secured when the blank is made as shown in Fig. 7, is more advantageously disposed with reference to the pitch line than is the corresponding surface of the conventional form.

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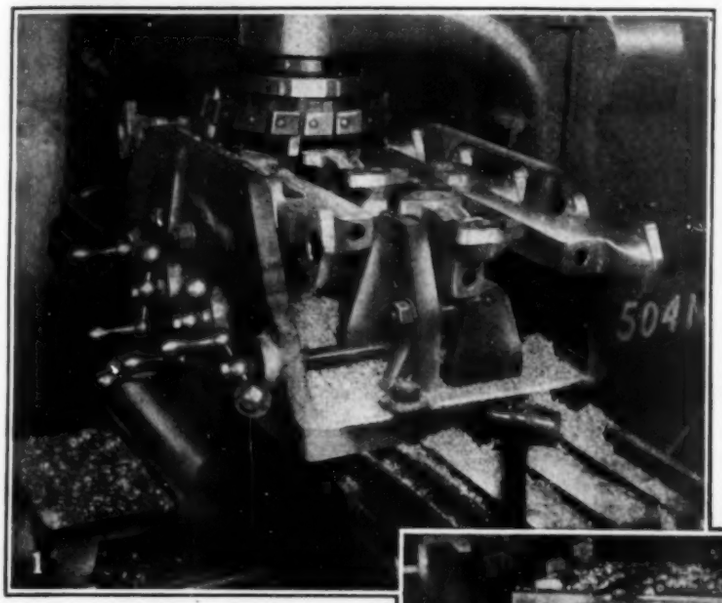
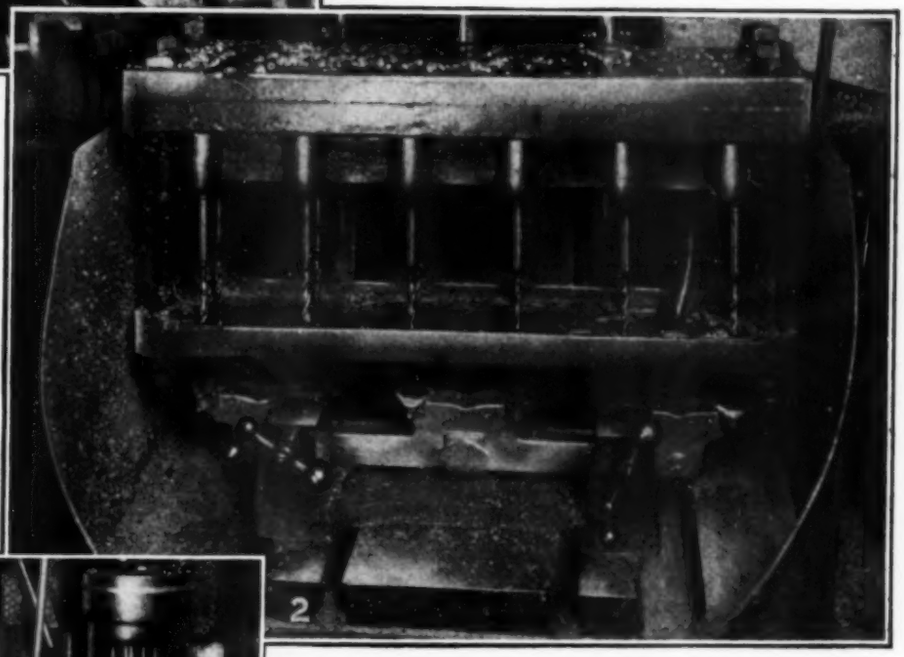


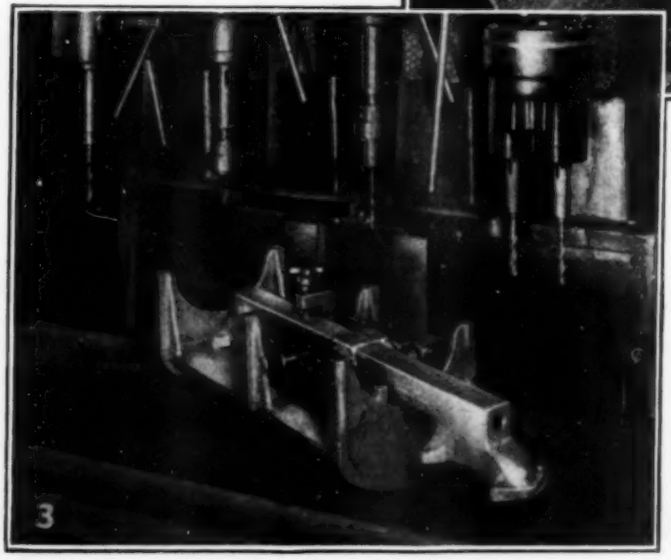
Milling and Drilling Manifolds

Photographs by courtesy of the H. H. Franklin Manufacturing Co.

1—Milling manifolds. The three-position fixture is so designed as to hold three manifolds at once, so that three different surfaces will be milled, giving a manifold completely surfaced at each pass of the milling cutter. Both sides are milled with the manifolds in the positions shown. The manifolds at the sides are located by dowels



2—Drilling the manifold flanges. The manifolds are held in two small screw vises on the machine table. A special drilling head carries the 12 spindles and the guide plate



3—Drilling the side holes in manifolds. The fixture is of the rocker type so as to be easily rolled from one side to the other. It is of aluminum with steel bushings

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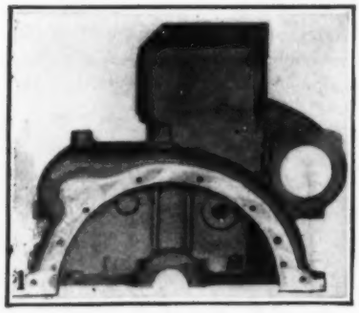
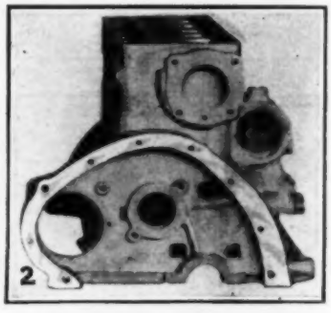
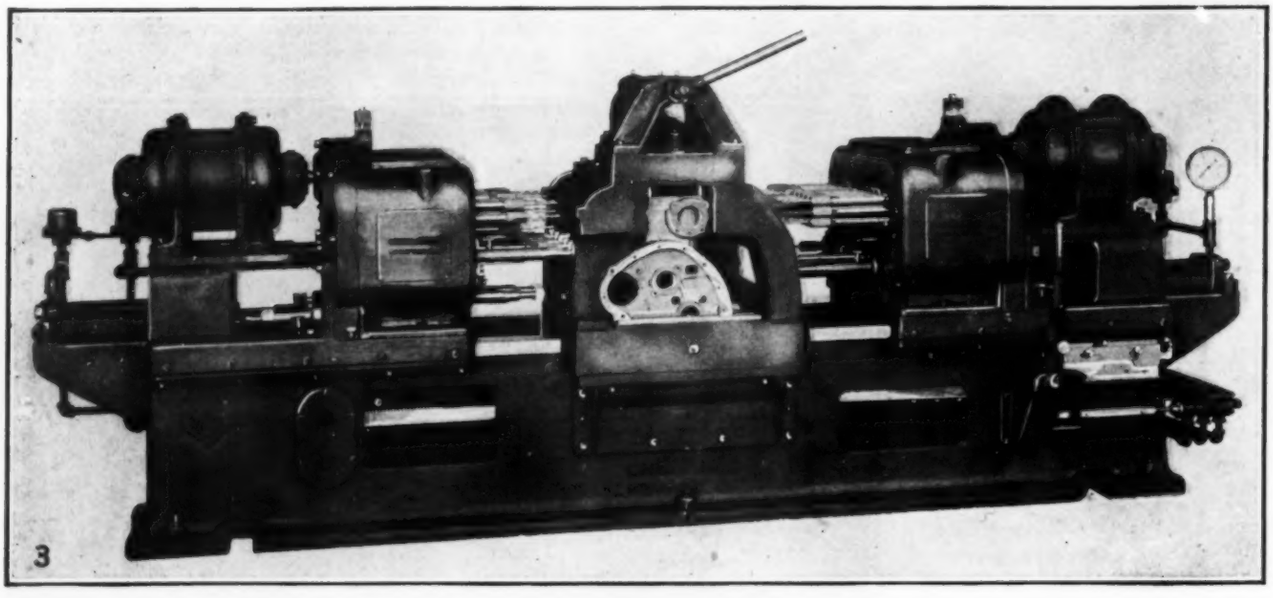


1 and 2—Ends of cylinder block



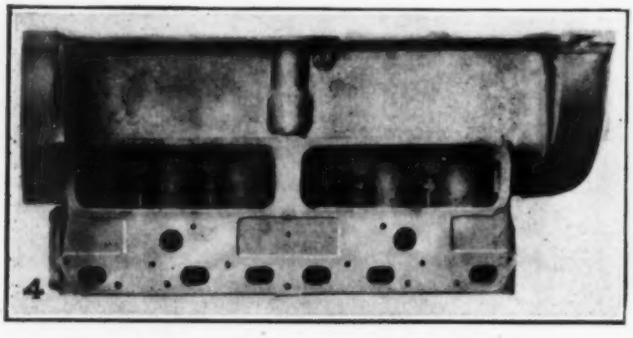
Drilling Chrysler Cylinder Blocks

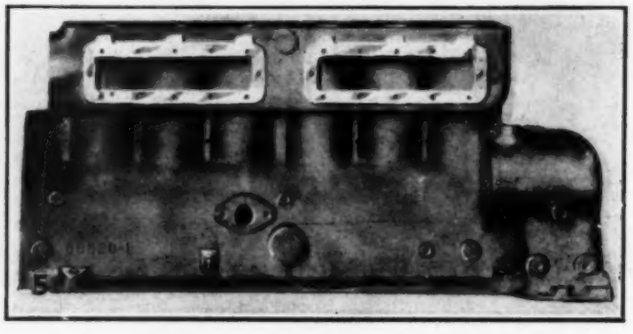
Photographs by courtesy of the Chrysler Motor Car Co.



3—Hydraulic feed, 50-spindle, Barnes machine. Two motors, 7½-hp. for 19 holes; 10 hp. for 31 holes. Drilling cycle 0.6 min., total time 0.7 minutes

4 and 5—These views show both sides of the cylinder block and the location of the holes drilled on the machine in Fig. 3. The machine is arranged to permit easy and rapid loading and unloading by affording a clear opening for the cylinder block, and by providing easily-operated clamps on top for holding it in position





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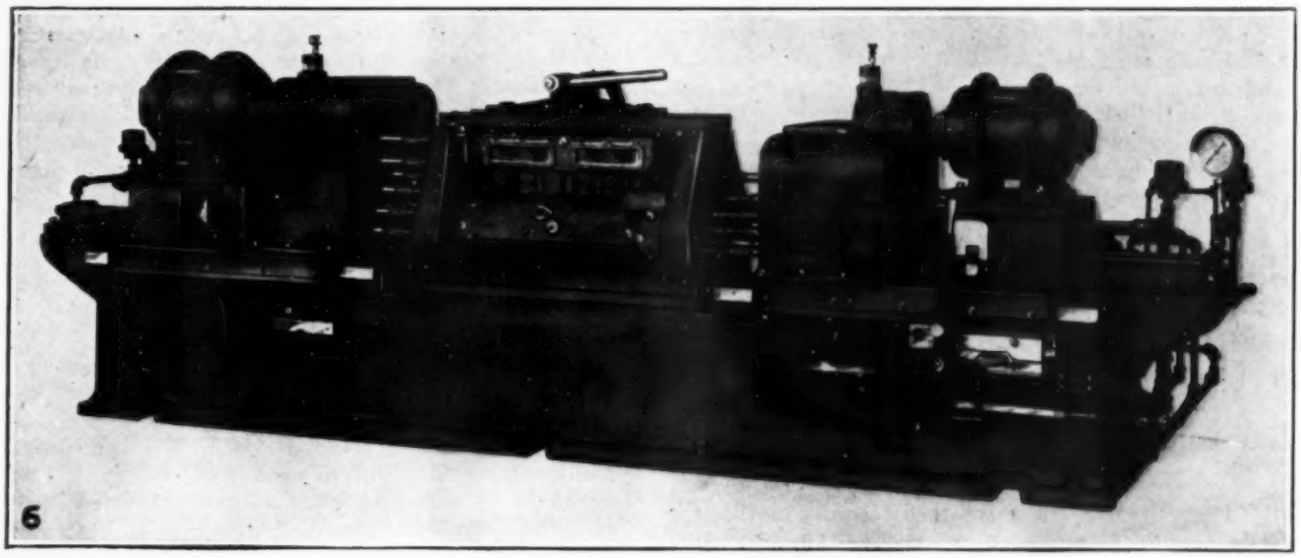
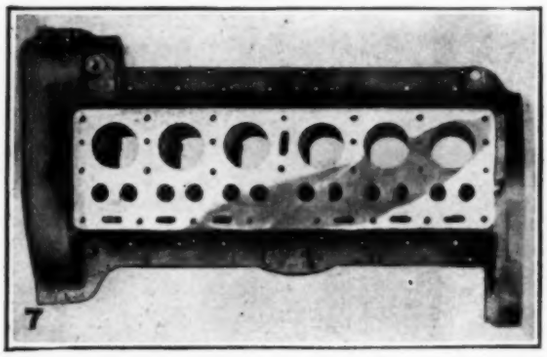
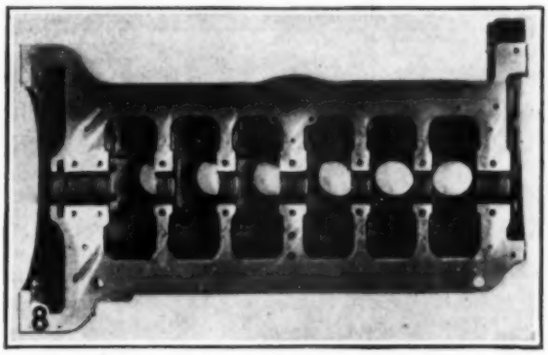


6—Similar machine for drilling 31 holes in end of block. Motors, 5 hp. for 12 holes; 7½ hp. for 19 holes. Drilling cycle 0.7 min., total time 0.8 minute

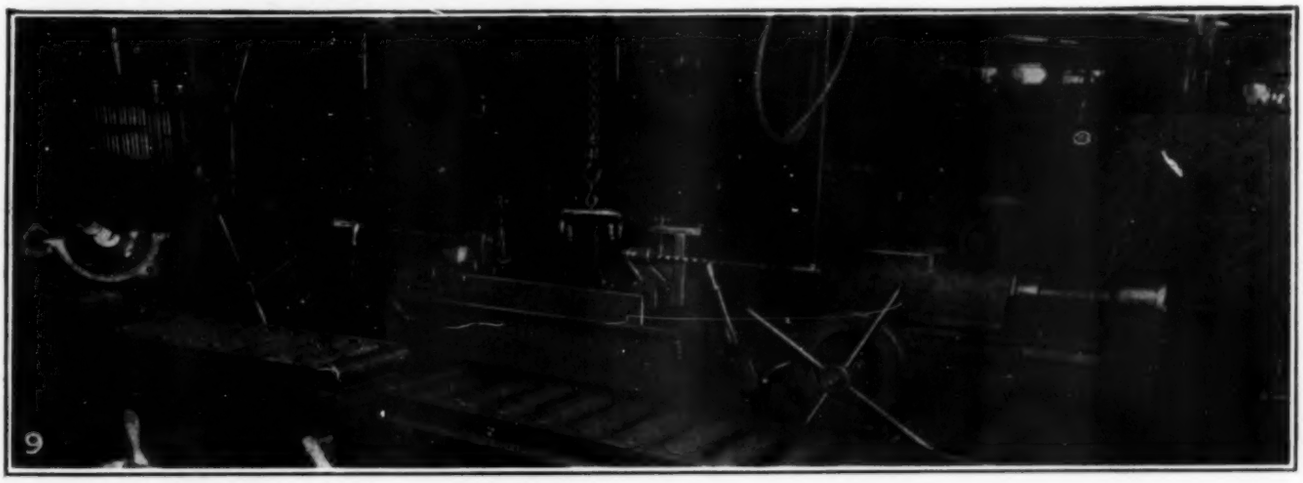
8—Bottom view of block that shows the holes drilled, not only in the crankcase flange but also for the 7 bearing caps of the crankshaft





7—Upper end of cylinder block showing holes drilled for studs, and for bolts that fasten the oil pan to under side of crankcase

9 — Barnes machine drilling 19/32-in. oil supply line hole. Cutting speed 80 ft. per min., feed 7 1/4 in. per min., or 0.015 in. per rev. Work cycle 2 min. 15 sec.; load and unload 52 sec.; total 3 min. 7 seconds

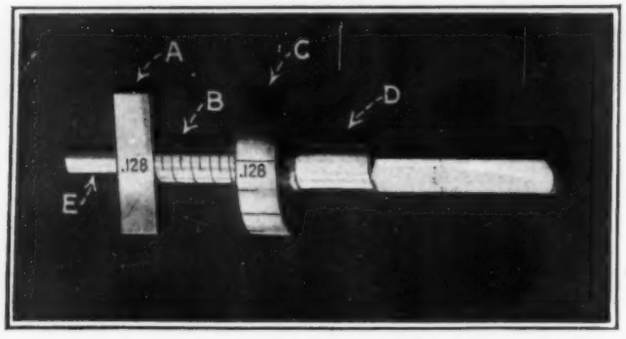


A Grandfather of American Micrometers

By Ellsworth Sheldon

A FEW days ago while I was discussing with members of the office staff at Winter Bros. the subject of accurate measurements, especially as they were considered in the old days with respect to their application to screw threads, John Winter bethought himself of a curiosity then reposing in the office safe and brought it forth for inspection. It is shown in the illustration.

The tool is a micrometer caliper and depth gage made by John Birkenhead, who in 1860 or thereabouts ran a shop in Mansfield, Mass., where he made spindles for cotton mills. It is thus not less than sixty years old and may be several years older. It was given to Mr. Winter many years ago by Mr. Birkenhead, who said that at the time he made it he had never seen or heard



An early micrometer caliper

of the micrometer principle as applied to measurements; a quite creditable statement, since it was not until 1867 that Brown & Sharpe introduced in this country the micrometer gage that grew out of the "Systeme Palmer," patented in France some years before.

The rectangular head *A* and the barrel *B* are in one piece. The disk *C* and the hexagonal thimble *D* are also a single piece. The screw, of which the measuring spindle *E* is a part, is either threaded tightly or forced into the thimble at the outer end of the latter (the bottom of the bore), since the ring made by the joint is plainly discernible. By some means which close scrutiny under a glass fails to disclose, the screw is prevented from coming out of the barrel, and the tool cannot be disassembled. The screw turns freely until the end of the spindle is flush with the head.

The screw is of 32 pitch and upon the disk *C* there are 16 division marks, stamped 128, 64, 48 and 32, progressively, at the quarter-turns. A zero appears upon the same line with the 32, and the same sequence of figures is stamped upon corresponding sides and ends of the T-shaped head.

Lines $\frac{1}{8}$ in. apart encircle the barrel and short marks between them indicate the $\frac{1}{16}$-in. measurements. It is obvious that one division of the disk represents $\frac{1}{32} \times \frac{1}{16}$, or 1/512 inch. Measurements are thus calculated by first counting the exposed lines on the barrel for the major divisions and then adding the number of lines on the disk that have passed the zero mark, exactly as is done with a modern micrometer except that the results appear as binary fractions instead of decimals. Measurements of 32ds, 48ths, 64ths, or 128ths may be read directly from the figures without counting the lines on the disk.

The manner of applying the tool as a depth gage is clear, since it differs in no respect from the modern tool of that name. Corresponding diameters are measured in the gap between the disk and the head. A drawback to close measurements lies in the fact that to match the lines of the disk with the zero line on the head a sight must be taken across the gap.

A Monument to a Passing Art

By Glenn Quharity

THOUGH the chestnut tree has about disappeared from the countryside, and with it (though not for the same reason) the smithy, there are still to be found a goodly number of horses; and each, according to the peculiar notions of civilized mankind, must needs have the provisions of a beneficient nature supplemented by having iron contrivances nailed upon his (or her) feet. That the business of shoeing horses, once the main resource of the village blacksmith, has not entirely

passed into the limbo of forgotten arts, is attested by the monument of horseshoes to be seen in the picture herewith.

There are in this pile about 20,000 horseshoes. Allowing four shoes per horse this particular smith has shod about 5,000 horses in the twelve-year period that this stack has been accumulating.

Distributors' Problems from the Buyer's Viewpoint

By JAMES A. SMITH
General Superintendent, General Electric Co., Schenectady

I THINK it might be well if most men who have to do with the selection of machinery, equipment or supplies, might have a time, as we say, "on the road," so that they would get a rather better perspective of the side of the question with which they rarely come in contact. Many people seem to have the idea that somehow, some way, they can take out of the clear air almost anything they want, at the time that they want it and at the price that they are willing to pay, and if the dealer or his representative, or the manufacturer or his representative, as the case may be, fails to meet their expectations in that regard there is something the matter with him. Well, there may be, but I think that in most cases there may be something the matter with the man who is trying to pick it out and expecting the impossible. And while I presume that like most other human beings I fail in regard to the other fellow's point of view a little, I try to be as considerate as I can in that respect. And that, I think is probably a part of the limited education that I obtained in the selling end of the game. And I believe that it would be a very desirable part of the preparation of any machine tool salesman if he could be in the factory for a while, and for a factory man to be outside for a time, so that they would get a look at both sides of the question, because they are very definitely related. We find in dealing with the men who visit us, who, of course, represent both dealers and manufacturers that, take them by and large, they are well informed. From them we are able to find out what the other fellow is doing, how he is doing it, and if we are on real confidential terms we may even find out how many he is doing, which is a desirable thing to know, not that he won't try to do as many as he can in spite of that fact, but if he is doing anything better or faster than we can, we would like to know it in order that we may emulate his example. But one thing I have learned and that is that it is a pretty good idea if you go to call on a man to appreciate the fact that he may have something else to do. It isn't altogether desirable to have the machine tool salesman come into your sanctum, if he is able to pass the outer guard and some of the other persons who may desire to, well, perhaps, impede his progress, and to have him take off his coat and vest and hat, lay his gloves and stick down, maybe take off his spats and light himself a cigar, and settle down for a fine afternoon or forenoon's visit, if you will. Now we are always glad to see these gentlemen, partly because we like them, and partly because of the things we may be able to get out of them, but most men who have anything to do at all aside from playing golf and certain other kindred industries, ought to make an effort, so far as they can, to do a little something for the interest of the concern that is paying them their stipend, be it much or little. And, consequently, if I have any recommendation to make to a machine tool salesman, it is something that I heard a man say once with reference to speakers, and you will appreciate the point of this as I go on. He said, "Stand up, that you may be seen; speak up, that you may be heard; and shut up when you are through." I have found men who didn't have any facilities whatever for the third requirement. And that is very desirable particularly if you have about forty other fellows on about forty different things waiting to see you.

> The dealer, as distinguished from the salesman, owes it to himself and to his clientele to see that the men who represent him, or them, are of the caliber who are capable of going out and discussing intelligently the problems incident to the equipment they are handling. The men who go out and represent the dealers or manufacturers should have as good a knowledge as is possible of the line they are representing. They ought also to have some proper appreciation of the advantages, if any, of the competing lines

The things which a machine tool salesman or supply salesman may be able to do for a manufacturing organization are numerous and important. It frequently occurs that he may be the most direct avenue to certain information that you need as to where certain things may be obtained, and when. He is in touch, or should be, with the newest developments in the art, and in that

From an address before the Associated Machine Tool Dealers at Granville, Ohio, May 25, 1927.

capacity alone can be of infinite value to the people upon whom he calls, because manufacturers and those who are employed by them, like myself, are for obvious reasons very much confined to their own task within their own immediate bailiwick. We don't have time to get out and visit the great machine tool centers or manufacturers and keep in complete touch with the latest developments. And in these days of very vigorous competition in all lines (I presume that extends even to machine tools) we might overlook something which would be very desirable from a cost standpoint or for production. That is a service which the well-informed machine tool man can render to the clients of the house which he represents. And I might say that generally speaking he lives up to that part of the program.

Aid in an Emergency

I think that the incidents which were associated with our war and the preparations for it contained some of the most striking illustrations of what machine tool salesmen and dealers can do for manufacturers of other than machine tools. It was necessary in the case of our organization to build up after the depression of 1913. When the war first started in '14 we had to build up in many instances with machinery which was entirely foreign to our regular lines of manufacture, and I want to testify here that my acquaintance with many of the dealers and salesmen in this country was of inestimable value in getting together in a short time many of the things which might, under different circumstances, have been withheld to a point where we would have been hampered very materially in the program we had undertaken. And I feel sure that in any emergency of that character —and I am not particularly anxious for a similar experience—the salesmen and dealers of the country can be of great assistance to their customers in the procuring of such things as may be necessary because of their intimate contact with the manufacturers, and their knowledge of where and when equipment can be procured. I know that during that period it was necessary for us to obtain machines that we formerly bought one or two at a time, in lots of perhaps one hundred to one hundred and twenty-five at once. In the nature of things it would be impossible for any one manufacturer to supply equipment in that quantity on short notice. Consequently, we were compelled to put ourselves in the hands of our friends, and perhaps the representatives of several dealers would be consulted and would get together equipment which, while not identical, would perform the functions that were necessary and with sufficient interchangeability so that it didn't present serious difficulties in the operations in the factory. In all these things the salesmen and manufacturers co-operated to the very best of their ability and I think in a manner which was surprising to many of us who felt that we knew the general situation.

Now with reference to what the dealers can do. I think the dealer, as distinguished from the salesman, owes it to himself and to his clientele to see that the men who represent him, or them, are of the caliber who are capable of going out and discussing intelligently the problems incident to the equipment they are handling. Of course, I realize fully that as the business grows and new men come into the field it is frequently the case that you have to meet some young man who perhaps has had inadequate training for the satisfactory meeting of all of the problems that are likely to be presented to him, but to those men I think the dealer should give all the training that he possibly can, and also that the customer ought to show them a reasonable amount of leniency in the event of their having certain shortcomings in the way of lack of experience and so forth. But in the interests of the dealers and manufacturers, as well as the customers, I do suggest that the men who go out and represent the dealers or manufacturers should have as good a knowledge as is possible of the line they are representing. They ought also to have some proper appreciation of the advantages, if any, of the competing lines, because, working for a large concern as I do, it isn't always possible to fill our factories full of any particular line of manufactured goods.

The question of how the activities of the dealers and their representatives should be carried on is also a broad question. I think in that respect perhaps the works where I am are a little bit different than some of the others and it is possibly as much my fault as anybody's. It is my feeling that the man who is directly responsible for the output of equipment should have considerable to say about what that equipment should be. In other words, I don't believe in a purchasing department, a master mechanic, or some other individual, knocking a man down and kicking him for falling. Every man in the factory, if he is in a responsible position and has the knowledge that is supposed to go with his job, has certain rather definite ideas about the kind of equipment that he would like to use for a certain job. And I believe that the ideas of that individual should be given weight in the selection of such equipment. Naturally, if he has something to say about it you can very much more readily and honestly hold him responsible for the results.

Dealer's Representative Preferred

One of the questions which comes up, I presume, among the men in the distribution of equipment of various kinds is whether there is any preference between the dealer as such and the direct representative of the manufacturer on the other side. There are a great many arguments in favor of one or the other. My personal preference, or maybe prejudice, is for the representative of the dealer rather than the manufacturer, because the manufacturer's representative, if he is as most of them, are, factory trained, does not have as broad-gaged a conception of the business at large as does the dealer or a well-trained representative of the dealer who is dealing not with one particular thing, but with many things. And while I realize that there are in the trade opportunities for both kinds of representation and perhaps excellent reasons why both should exist, as I have said before, I prefer to do business through the dealer.

One of them is a conservation of time, because if you have direct factory representation by individuals and you have a matter of five or six separate tools, it might take you nearly all day to interview five or six different people, whereas it would be an easy matter to sit down with one well-informed person and close the whole job out within half an hour.

If a well-informed machine tool man is permitted to go into the factory and discuss with the division superintendents or foremen their particular problems, he is in a position to suggest to the prospective user new machinery, new equipment, new methods, and in general, he brings to the attention of the management and

to the men under them the ways and means by which their business can be much more successfully prosecuted. And I think that in itself is sufficient justification for giving, as we do, the widest possible latitude to proper representatives to enter our factories.

Of course, in years gone by it was customary in factories to build the street wall without any windows; or failing that they painted them, so that nobody might possible see in. But in my limited experience I have found that the man who closes his windows shuts out a lot more than he shuts in, because the world is much bigger than his institution. Of course, there are abuses that might grow out of any system. And we have had and I presume other people have had, where this idea prevails of permitting the salesmen to go promiscuously around, cases where they might bring undue influence to bear upon some weak-kneed individual who might recommend something that down in the bottom of his heart, if he had any, he really didn't believe in. However, I have always believed in direct control and we have no trouble of that kind where I am, because I usually sit on the lid a little; not often have we had occasion to suggest to a man that he might curtail his activities a little, but when it is necessary we do it, much as it may hurt our feelings, we do it with a lot of vigor, I don't hesitate to tell you. There are other things that dealers have to contend with. I think, first, if they are going to live up the best traditions of their profession they owe it to themselves and to their salesmen and to their prospective customer to assemble a comprehensive line, so that their representatives may be in a position to meet almost any kind of an emergency which may arise. I appreciate that it may not always be possible to get together just the line that everybody would like, but judging from my limited experience in machine tools, particularly, and that also applies to small tools, matters have progressed very materially during the last five or six years, so that where a person might have had a rather limited choice a few years ago he is today confronted with the problem of selecting the best from a really high-class collection.

I realize that there will always be an opportunity for the sale of lower priced articles. There are, in fact, many places where the higher priced goods will not justify the expenditure, either because they are used intermittently or perhaps because the character of the work or the kind of people that are likely to have to use them won't make the increased investment advisable. But I think I can say from our experience that equipment today is generally very, very much better than it was a few years ago, and I believe that not only the constant demands of the trade as represented by the consumer but also the suggestions and perhaps rather insistent demands of the selling forces of the country have had as much to do with that as has any other one agency.

I dwell upon that because the dealer or his representative are on the firing line all the time. They see things which the manufacturer, however good, may never see—he can't—in the nature of things he isn't big enough to get around and see all of these things. And I believe that the dealers and their representatives can do a very great deal for the industry at large in pointing out improvements which are found to be desirable in their contact with the trade, and perhaps the elimination of some things that the manufacturer who is desirous of being on good terms with his designer may have put on, either for beauty or probable utility. In connection with this, the right kind of a man, either a dealer or a representative, can be of great assistance to the manufacturer not only in pointing out the advantages of his own equipment, but also some of the places where the product of the consumer may be changed to facilitate manufacture. It is a mournful fact that not all of the men who are in the metal industries of the country are familiar with the difference that the elimination of a corner or the taking off of a boss or something of that kind may have upon the total cost of the apparatus when finished. Of course, that subject is one which is being given constant attention by manufacturers, by engineers, by designers and others. However, the right kind of a machine tool salesman can go into a man's shop and see something which is being made in a manner which he knows could be, either on machinery which he represents or some other, very greatly reduced in cost if it were changed in some perhaps very minor particular. And while we don't expect all of the dealers who come to us, or their representatives, to furnish us an unlimited amount of consulting engineering service for nothing, we avail ourselves of that sort of thing and it works out very advantageously to us and I haven't the slightest doubt it works out advantageously to them, because after all their business to create sales and sales opportunities. Some one has said that there is probably no greater coward in the world than a million dollars, unless it is two millions, and I don't believe that any concern is so big that it can't afford to take a high-class suggestion from anybody regardless of whether he is trying to sell something or not. Certainly, we take them and are delighted if we can get them—and we get a great many.

Another thing that can be done is to go through your

If a well informed machine tool man is permitted to go into the factory and discuss with the division superintendents or foremen their particular problems, he is in a position to suggest to the prospective user new machinery, new equipment, new methods, and in general, he brings to the attention of the management and to the men under them the ways and means by which their business can be much more successfully prosecuted. I have found that the man who closes his windows shuts out a lot more than he shuts in, because the world is much bigger than his institution

plans and look over your work to see what can be done in the way of the introduction of special machinery. I don't mean "special" in the sense that it has to be designed from the ground up, but the possibilities are very numerous for special attachments to standard tools. Personally, I have never been a very strong advocate of the single purpose machine where you have a multitude of little gears and spindles and various equipment of that character because with us—and I presume it is true with others at times—we have to face the possibility of changes, which may mean the elimination of this machine with the consequent loss of capital investment. And it is also true that if you have one of these highly special machines and some rather minute part, some little gear, some little spindle goes bad (and they will) your whole outfit is down. We find that it is more desirable to use standard tools so far as we can, and wherever it is necessary through the agency of the dealer, or his representative, or perhaps through some ingenuity on our own part, put some special appliance on it, which, should the necessity for that particular operation disappear, can be removed without a total loss of the whole machine.

And in that way the dealers and other representatives contribute a great deal, because they know the possibilities, they have seen them in other places where we haven't, and while we may have thoughts on the subject we don't have the opportunity for visual inspection or for checking up production sheets and various other things which are in the hands of manufacturers and so come down through the dealer to his representative.

There is one disagreeable thing that is disappearing but that still prevails, I believe, to a limited extent and that is the idea that some one person or some one concern is the only person or concern that makes a good job. That is, to use the language of the day, "knocking the competitor." Now, of course, we all have our likes and dislikes, and some of us believe from our experience and contact with things that we can discriminate between a desirable connection with some concern and an undesirable one. And some of us don't believe it is highly desirable to have that pounded into us too hard by some fellow who probably doesn't know as much about it as we do. We don't have much of that but we shouldn't have any. It isn't desirable, and I think it is bad policy. It is with me. I feel about that very much as I do when some man comes in from the factory to tell me some dirty yarn about what some fellow has done. There isn't any place in legitimate business for that sort of thing. While it may be welcome in some spots I don't happen to inhabit one of those spots.

Give Your Competitor and His Product Credit Once in a While

It isn't a bad idea for a man who is representing a certain line of goods to admit once in a great while under the extreme stress of circumstances that the other fellow may have something that is good. And I think that an organization of this kind, composed of representatives, I presume, of competing lines in many instances, does a great deal to further that sort of thing. Generally speaking, I have found that the more you know a fellow, the more likely you are to get along with him. I know I am, because if I am associated with him for a time and I don't like him, why we quit associating. Consequently, the remnant of our friends are what you might call hundred per cent people. They are the kind of people who make for the upbuilding of industry in this country. And in the upbuilding of the mechanical arts in this country I think the dealers and distributors have had a much larger part than is generally credited to them, because without their knowledge of the requirements of the field and their intimate association with prospective users there wouldn't be that incentive to the producer either to keep his equipment up to date, introduce improvements if necessary or perhaps effect economies in manufacture that make output salable when it is done. Almost any high-class mechanical man can do a good job, but if he can't do it at a price that permits somebody else to sell it, he is wasting a lot of his time.

Seen and Heard

By John R. Godfrey

Getting results from reamers

IT'S A bit peculiar how often we find that several things must be tied together to secure results. A case in point is a new reamer I ran across the other day, used for reaming automobile cylinders and similar work.

The reamer itself is a good-looking tool. Blades held firmly in the shank, and the other points well designed. It's doing a remarkably good job, too, with the astonishing feed of $\frac{1}{16}$ to $\frac{3}{8}$ in. per revolution, and leaving a surface that is a joy to look at.

But the joker is that, in spite of the reamers' good points, the tool of itself probably wouldn't make a dent in the reaming problem of this particular shop. If the reamer had to be ground, backed-off, and then ruined with an oil stone, as is customary, it wouldn't be much better than the usual reamer as to really economical results.

The brother of this reamer, however, is the machine for grinding it and backing it off. Either one alone wouldn't be worth making much of a fuss over. But when the reamer needs to be reground, it goes on a special machine that grinds and relieves the entering and exit angles and the cutting portion, all at one operation. And the deadly oil-stoning process is omitted entirely. The result is that all the reamer blades cut, none having been rounded off, or dulled, by the oil stone expert, and every blade cuts its share of metal in much the same way as a good, broad-faced tool, such as cut the chip shown on page 53 of this volume.

We are learning—all too slowly it seems—that the old idea as to hand finishing of surfaces isn't all that it was cracked up to be. We'll never know how many good cutting edges have been spoiled by the over-ambitious oilstoner. And when it comes to scraped bearings there is much to be said. The manager of the factory making one of the best known high-grade automobiles once said to me—"after we bore and ream a bearing as perfectly as we know how, we don't want anyone digging holes in it with a scraper." We're learning this lesson slowly—but it's coming.

It's a pretty safe statement to say that if we can't make any kind of a bearing more nearly perfect with a machine than by hand, there's something wrong with either the machine or the method.

Machining and Measuring Gear Teeth

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Other methods for checking the eccentricity and alignment of gear teeth—Measuring the tooth spacing by means of the odontometer and other instruments—Determination of the correct profile

ANOTHER method of measuring the eccentricity of gear tooth profiles consists of mounting the gear in a testing machine and meshing it tightly with a master gear as shown in Fig. 13. One of the arbors on which the gears are mounted is stationary while the other is mounted on a slide. The gears to be tested are held tightly together by the pressure of a spring acting against the movable slide. As the gears are rotated, any eccentricity that may be present causes the slide to move back and forward accordingly. The dial indicator at the end of the machine is used to measure any movement of this slide. The difference between the largest and smallest reading on the dial indicator shows the amount of run-out of the gear tooth profiles. As noted before, this run-out is double the eccentricity.

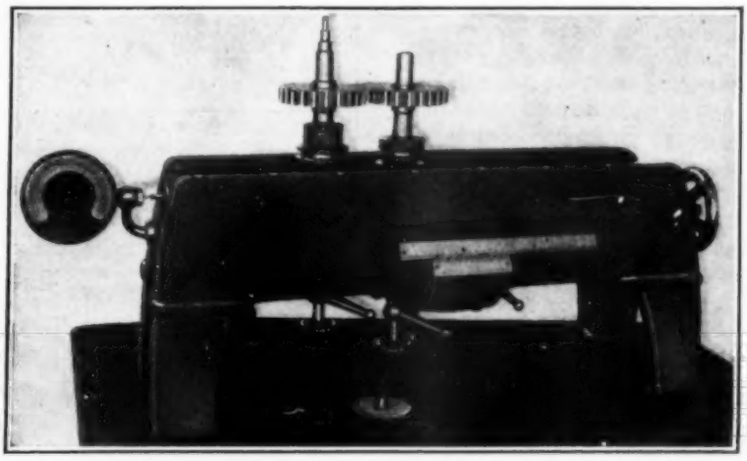


Fig. 13—Machine for testing eccentricity of a pair of gears

Another method of measuring the eccentricity of gear tooth profiles employs a projection lantern. In this case the gear is mounted on a stud, while a tooth profile that is from 90 to 120 deg. away from the profile being projected is held against a stop. A line representing the tooth profile is drawn on the screen and the stop is adjusted so that this line coincides with the projection of the first tooth tested. Successive profiles are then brought in contact with the stop. Any deviations of the successive projected profiles from the line on the screen are measured. In effect, this measures the cumulative spacing errors over the number of teeth between the stop and the profile projected on the screen. Such cumulative errors are primarily the results of eccentricity, so that this method is practically a direct measure of eccentricity, and the measured deviations on the screen can be converted into actual gear errors.

The third article. The fourth will appear in an early issue.

Why should the alignment of gear teeth be measured?

If mating gear tooth profiles are not in almost perfect alignment, the load will not be distributed evenly across the face of the gear. If the mis-alignment is appreciable, the load will be concentrated at one edge of the gear blank, thus causing excessive local wear as well as excessive noise at high pitch-line velocities.

As with eccentricity, the alignment of the gear teeth should be maintained by care in setting up the blanks for machining as well as care in maintaining the gear cutting machines themselves in good operating condition.

How can the alignment of gear teeth be measured?

The simplest and most effective method of testing the alignment of the gear teeth consists of mounting the mating pair of gears at their correct center distance on parallel shafts and running them together under a sufficient load to show the nature of the contact between them. Gears thus tested should show contact entirely across the face.

The alignment of the teeth of large spur gears may be tested by setting them up on a surface plate and testing both the bore and the tooth profiles with a try-square.

Why should the spacing of gear teeth be measured?

If the spacing of the gear teeth is not uniform, the gears in operation will be noisy and also the maximum load carried by the teeth will be increased because of such errors, or conversly the permissable load to be carried will be correspondingly reduced.

The accuracy of the spacing of gear teeth is controlled primarily by the accuracy of the gear cutting machine and the accuracy of the generating tools. Therefore measurements of spacing on a cut gear should

Fig. 14—Checking spacing errors by pins.

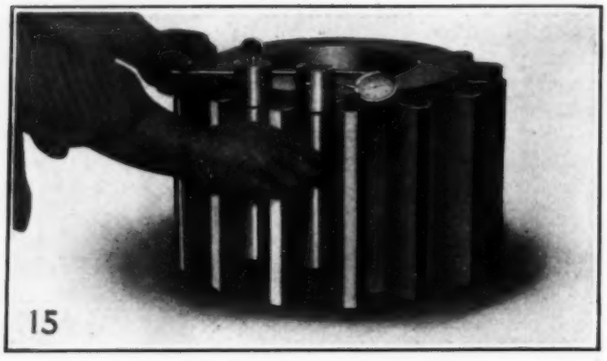


Fig. 15—Modified method with indicator

be made to test the accuracy of the production equipment rather than the product itself. If tests of the product show spacing errors of troublesome amounts, both the generating tools and the gear cutting machine should be tested to locate the source of the trouble. Suitable steps should then be taken to correct whatever is at fault. Excessive spacing errors on the product should always be a signal to stop production and correct the equipment.

How should the spacing of gear teeth be measured?

Several methods are available to test the spacing of gear teeth. One simple method is to place two pins in adjacent tooth spaces and to measure over them, as shown in Fig. 14. As these pins are moved from space to space, any differences in these measurements indicate a variation in the spacing of approximately the measured difference.

This same method, applied in a slightly different way, is shown in Fig. 15. In this case the pins are extended and a bent rod carrying a dial indicator is mounted in one of them. This is the same device as is shown in Fig. 12 in the preceding article for testing eccentricity. The indicator is rocked past the second pin and any differences in the readings as the pins are moved from space to space indicate the errors in spacing.

The odontometer is a simple and self-contained instrument for testing the accuracy or uniformity of the gear tooth spacing. The instrument illustrated in Fig. 16 has a range of from 3 to 10 diametral pitch and may be used to check gears of any pressure angle. It can be applied to a gear while it is in place in the machine.

In effect it is composed of a section of a straight-sided rack with two parallel effective faces, one fixed and the other movable. A third face, set at an angle to the two working faces, is used to hold the fixed working face in contact with the flank of the gear tooth. The fixed registering surface is at *A*, the movable indicating surface at *B*. The third surface *C* holds surface *A* in contact with the involute surface of the gear tooth. The surfaces *B* and *C* are adjustable so that gears of various pitches can be tested with the same instrument.

The indicating surface *B* is mounted on two thin flat springs *D*, which act as pivots free from backlash. The dial indicator *H* is actuated by the lever *F*, which has a ratio of 5 to 1, so that each division on the dial represents a movement of 0.0002 in. of the indicating surface *B*. In order to explain the operation of this instrument, it is necessary to reconsider some of the characteristics of the involute profile. Fig. 17 shows a series of involutes equally spaced on a given base circle. The normal pitch *Pn* between these involutes along a line tangent to the base circle is always the same, no matter where the tangent is drawn. Fig. 18 shows a few gear teeth and indicates the portion of the involute where contact is made with the odontometer. The instrument is located over one tooth and rocked into contact with the adjacent one. When the movable face of the instrument reaches position *M*, the distance *Pn* should be registered. With true involute profiles, the hand on the dial will remain still

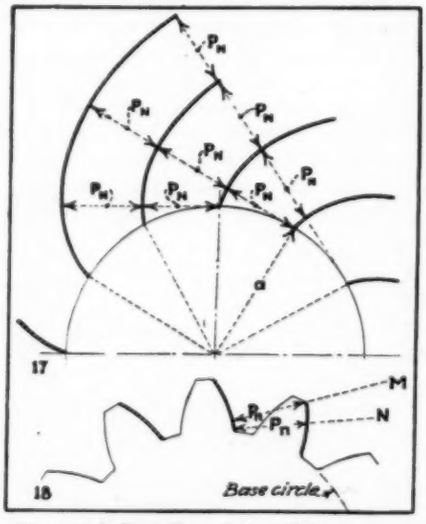
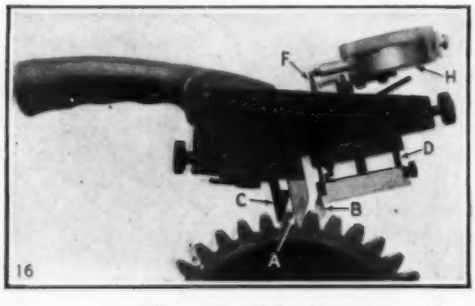
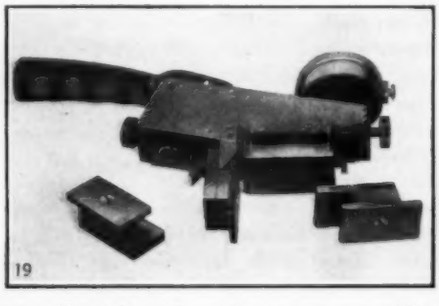


Fig. 17—Family of involute curves
Fig. 18—Theory of odontometer measurements





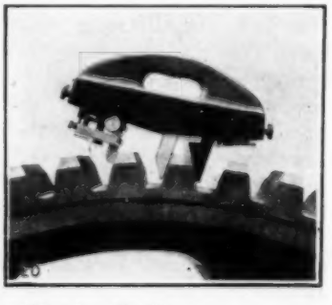
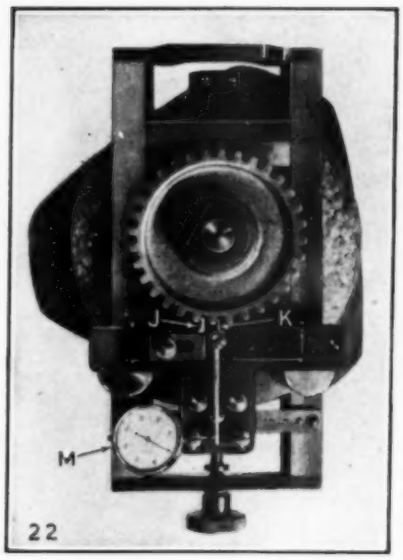


Fig. 16—Odontometer. *Fig. 19—Checking the odontometer reading with size blocks*
Fig. 20—Odontometer for large gears

until the instrument reaches position *N*. In operation, this momentary pausing of the hand on the dial is taken as the reading.

In general the instrument is used as a comparator to test the uniformity of spacing of interchangeable and mating gears. This normal pitch *Pn*, as noted previously, should be the same on mating gears. If actual measurements are required, the distance between the two parallel working faces of the instrument can be measured. Fig. 19 shows this measurement being made with size blocks.

A larger instrument with a range of from ¾ to 4 diametral pitch is shown in Fig. 20. This instrument has two dial indicators, one on either side, so that it can be used with either side of the instrument up when held in a horizontal position while testing large gears which are still set up on the cutting machine.



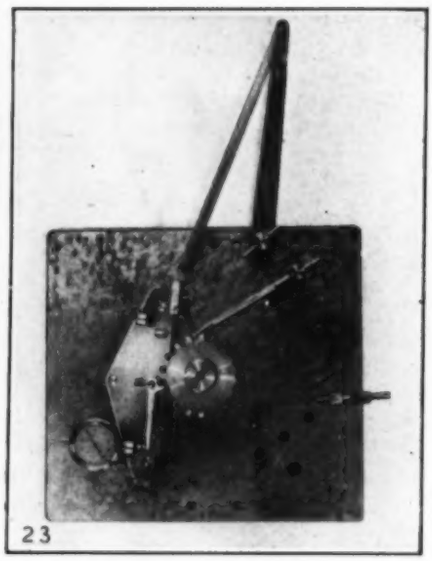


Fig. 22—Lees-Bradner spacing tester. Fig. 23—Kavle Indicator

A somewhat similar instrument, designed by A. W. Copland, is shown in Fig. 21. This is more of a single-purpose instrument for production checking and requires a separate one for each different pitch. It consists of a roll that fits into a tooth space and thus makes contact on one tooth profile and a pivoted finger that makes contact with the next tooth profile. Any variation in the position of this finger is recorded on the dial indicator. An adjustable stop is also provided so as to control the position where the finger makes contact on the tooth profile.

The Lees-Bradner gear tester may be adapted to test the spacing of gear teeth as shown in Fig. 22. The gear in this case is left free to rotate upon its arbor while the tooth spacing fixture and the slide frame are clamped firmly in position. The adjustable stop *J* is set to engage one tooth while the contact point of the lever *K* engages the next tooth. The long end of this lever engages the dial indicator *M*, which is usually set at zero on the first pair of teeth tested. The gear is then lifted out of engagement with the stop *J* and the contact point of the lever *K* is moved one tooth, and again brought against the stop. The indicator reads plus or minus variations from the original setting as each successive tooth is brought into contact with the stop *J*. These readings are in tenths of thousandths of an inch and indicate a variation in tooth spacing of practically the full amount indicated.

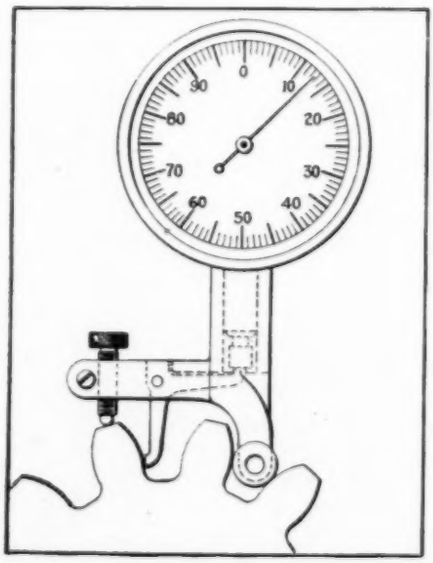


Fig. 21—Copland tooth-space measuring instrument

Why should the form of tooth profiles be measured?

An involute gear is a series of uniform-rise cams, used to transmit power or motion. If the transmitted motion is to be smooth and uniform, both the cam profiles and their relation to each other must be correct; otherwise irregular and noisy action will result.

Considerable stress is often laid upon the necessity of "easing off" the profile of involute gear teeth. Assuming rigid teeth of perfect form and spacing, such modifications are unnecessary. But as these conditions are never fully attained in practice, such a procedure often proves advisable. Edge contact at the beginning of mesh is particularly troublesome and should always be avoided. The amount of modification required is only just enough to avoid such edge contact and thus depends entirely upon the accuracy of the gears. The more closely they approach perfection, the less modification they require. Too much modification is often worse than none at all. The effect of such modification is to reduce the amount of contact. The safe permissible amount of modification is limited by the length of contact between the given pair of gears. If the "overlap" is small, very little modification can be permitted if quiet running gears are to be secured. Gear teeth designed to give longer lengths of contact offer greater opportunities of suitable modifications in order to correct for small errors, and hence smoother and quieter action can be secured.

Although theoretically the entire involute profile is suitable for use as a gear tooth profile, that part of it immediately above the base circle is so sensitive that it can be neither measured nor produced accurately. Many times, gears whose profiles and spacing seem to be almost perfect are far from satisfactory in operation. In the majority of such cases it will be found that such gears attempt to use the involute profile almost to its origin at the base circle, and errors are present there that cannot be detected by direct measurement.. The best practice is to eliminate this portion of the involute form from the active profile of the gear teeth. This can be accomplished in one of three ways. The first and most satisfactory method is to design the gear tooth forms so that the active profile stops an appreciable distance away from the base circle; about $\frac{1}{32}$

in. on 5-D.P. gears, for example. This is accomplished by extending the addendum of the pinion with a corresponding reduction in the addendum of the gear.

The second method is to remove entirely this portion of the profile. This can be accomplished by designing the generating tools so that they undercut and remove this part of the profile or by introducing a separate milling operation to remove this part of the profile. The third method is to "ease off" or modify the tip of the profile of the mating gear tooth so that it will not contact with the involute profile near the base circle.

The accuracy of gear tooth profiles depends primarily upon the accuracy of the gear cutting machines and the cutting tools used to produce them. The accuracy of these profiles can only be maintained by a rigid control of the accuracy of the production equipment. Here also, the testing of the profiles of the product should be used as a check on the accuracy of the equipment rather than as a product inspection operation. The production of inaccurate gear tooth profiles should therefore be a signal to stop the production, test the equipment, and correct the trouble at its source.

How shall the gear tooth profiles be measured?

Several instruments are now on the market for testing the accuracy of involute profiles. In most cases they consist of a disk representing the base circle of the involute to be measured, a straight edge constrained to rock on this base-circle disk without slipping, and an indicator point so located as to represent the end of the line that is unwound from the base circle to generate the involute profile. If the pointer of the indicator remains stationary while the point travels over the tooth profile, it indicates that the form of the tooth is of the correct involute shape. If it moves, the direction and amount of its movement gives a measure of the error in the tooth profile.

One instrument of this type is the Kavle Indicator, shown in Fig. 23. It consists of a base plate, a disk of the same diameter as the base circle of the gear to be inspected, a stud or bushing on which the gear is located, and a straight-edge which is held in contact

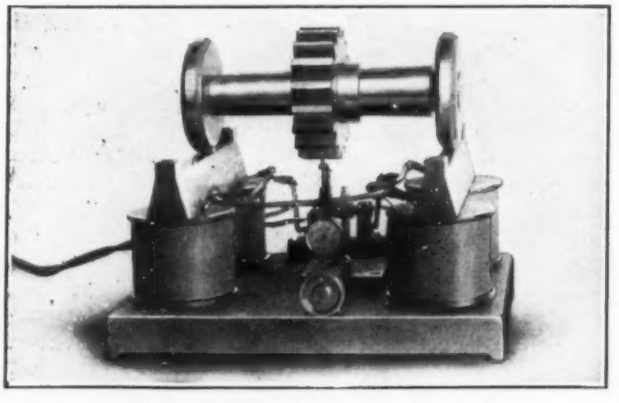


Fig. 24—Involute form tester

with the base-circle disk by means of steel ribbons, 0.002 in. in thickness, and a spring. On the straight-edge is mounted a 5-to-1 lever the short end of which is in contact with the tooth form while the long arm is in contact with the plunger of the dial indicator. This 5-to-1 lever multiplies the motion so that each division on the dial is equivalent to 0.0002 in. As the straight-edge is rolled on the base-circle disk, the point on the short arm follows the tooth form of the gear. If the tooth profile is of true involute form, the pointer of the indicator will not move. If errors are present, the dial indicator will show the direction and amount. The accuracy of the spacing of the teeth may also be measured by this same instrument by bringing each successive tooth in contact with a stop and taking the dial reading when the bar is held in a fixed position.

Another instrument of this type is shown in Fig. 24. This consists of a pair of straight-edges on which roll two base-circle disks of equal diameter. A magnetic circuit is made through the straight-edge and disk to prevent slippage. The gear to be tested is mounted on the shaft between the two base-circle disks. An indicator is mounted on the base of the instrument, the point of the finger of which is located so that it represents the end of the line which is unwound from the base circle to form the involute curve. The operation of this device is identical to the one previously discussed.

Unilateral Tolerance and Oversize Reamers

BY GEORGE L. CLOUSER

FROM time to time there have appeared in the columns of the *American Machinist*, articles dealing in one way or another with the limits that may be imposed on machine work. These articles, whatever may be their title, tend to approve the unilateral system of tolerances.

With the unilateral system of tolerances the writer has no objection; he was, so to speak, brought up on it. On the other hand he has worked in places where they *made* the stuff go together. But there are statements sometimes made that are not in accordance with my experience. It has been intimated that since commercial reamers are made oversize, the objection that reamers have less life where unilateral tolerance is used, does not hold good.

I have from time to time measured commercial hand reamers, and never yet did one of them measure noticeably oversize. The last one purchased, a nominal 1¾ in., measured 1.7502 in. which is not enough to make a loose fit, since the hole may come smaller than the reamer. I have reamers, not very much used, that will make holes for driving fits in cold-rolled steel; which holes seem always to be undersize. In this connection another word may not be amiss, and that is that it takes skillful work to make a standard-size hole with a standard-size reamer.

The blades seem to compress a little, making the hole slightly small. On the other hand, especially if the hole is short in comparison to its diameter, the hole may easily come a little large. I have seen the same man ream holes anywhere from right size to about 0.004 in. large, using the same 2-in. hand reamer. When reaming on the machine, the tendency toward large holes seems to be greater than when reaming by hand.

This is a matter that will no doubt be taken care of in time, so that it will be possible to pick up reamers that have a little wear to them before they begin to cut small-sized holes. But at the present time the truth seems to be on the side of the man who says that it is impossible to count on having holes always over the nominal size when using commercial reamers.

[With "standard-hole" practice, the shaft and not the hole is varied to secure fits of all kinds. This is equally true with either unilateral or bilateral tolerances.—Editor.]

Controlling Maintenance Work in a Steel Mill

By Frank W. Curtis
Western Editor, American Machinist

Handling repairs in quantity lots—Classifying the work according to its importance—Miscellaneous operations performed in the shop—Procedure in ordering

OPERATION of a machine shop in a steel mill differs somewhat from the average procedure, although the class of work handled closely resembles that encountered in a job shop. The necessity of keeping the mill machinery in running order is imperative and to this end centers the shop control. At the Minnequa works of the Colorado Fuel & Iron Co., Pueblo, Colo., a system has been installed in the machine shop to supervise the work in progress and to segregate it in accordance with its demand. The shop employs approximately 150 men and handles maintenance work for six rolling mills, one wire mill, one coke plant, five blast furnaces, fifteen open-hearth furnaces, twenty coal mines, and several lime quarries and iron mines.

All shop orders and requests for repair and maintenance parts are sent to the mechanical stores depart-

Form 1162—6-26—20M

THE COLORADO FUEL AND IRON COMPANY
MINNEQUA WORKS

DATE Dec. 1, 1926. CARD NO.

ACCT. NO. BALANCE ON HAND

TO SUPT. MECHANICAL STORES:

QUANTITY	DESCRIPTION
6	Table legs, Cast Steel, pattern 846

DEPARTMENT Rail mill

DATE REQUIRED Dec. 11, 1926

ORDER NO.

ORDERED BY

APPROVED. SUPT. MECHANICAL STORES

THE COLORADO FUEL AND IRON CO.
MINNEQUA WORKS

SHOP ORDER

DATE Dec. 1, 1926 S. S. ORDER NO. 2689
DELIVER MATERIAL TO Rail mill
CHARGE
DESCRIPTION Six (6) cast-steel, table legs pattern #864
Obtain height and layout of holes from rail mill dept.

OPERATION FOR Pattern DEPT.
OPERATION FOR Foundry DEPT.
OPERATION FOR Mach. Shop DEPT.
OPERATION FOR DEPT.

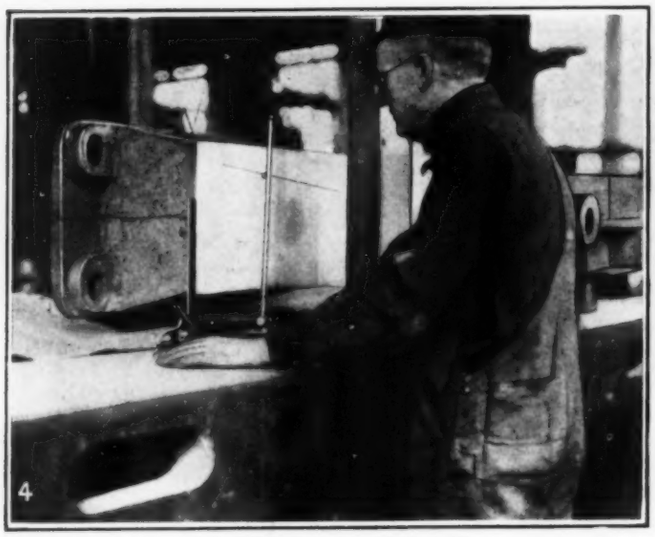
REMARKS Material wanted Dec. 11

Shop Order	Part No.	Drawing No.	Mat.	NAME	Date Required
2689	846	D/P 68	C.S.	Table legs	Dec. 11
MADE FOR	No. on Order	Tool Group	Department		Date Completed
Rail mill	6		Mach. Shop		Dec. 10

OPERATIONS	Rg	Mach. Hrs.	T.L.	Started	Completed
Plane top face		303	.9	5/27	5/27
Layout		LO	.2	5/27	5/27
Drill and tap		201	.65	5/27	5/27

The Colorado Fuel and Iron Company

Fig. 1—Form made out when maintenance material is requested. Fig. 2—Shop order that authorizes manufacturing of parts. Fig. 3—Machine-shop operations are listed on this form



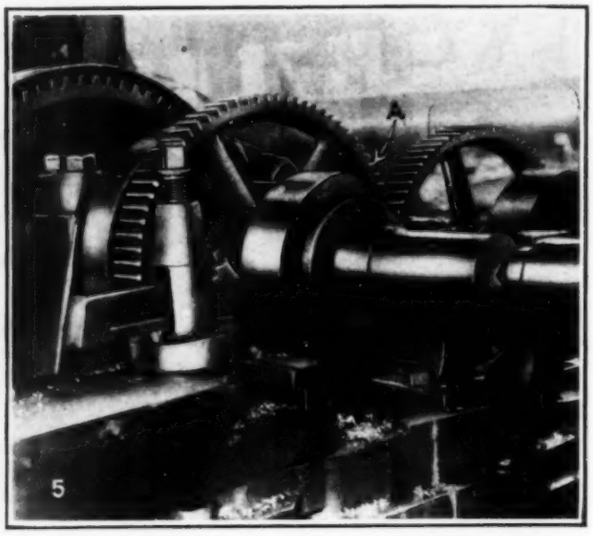
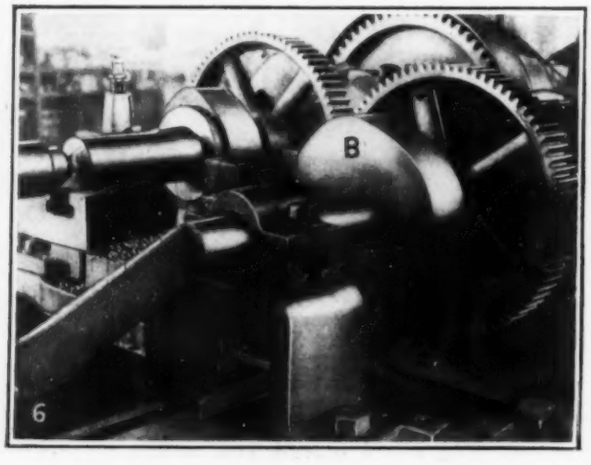


Fig. 4—All layout work is handled at a central point. *Fig. 5—Cams are turned by means of a fixture in which a master cam is utilized.*

ment, the duty of which is to check the necessity of the order and to specify the method of handling. Three classes of orders are in use. The first is a "breakdown" order that receives preference over all work. Work listed in this class is rushed because the parts required may be holding up some department that will tie up the entire mill. The second type is the "at once" order, specifying that the work is to be completed within the week it is issued. Repairs to mill machinery are made usually during the week end, and by completing these orders by the end of a specific week, makes available the parts for installation at a time when the machinery is shut down. Engineers' orders, specifying experimental equipment, also come under this class. Such work receives second choice because the material called for is intended to improve existing methods, and should receive immediate attention. The third type is called a "routine" order, and carries a due date permitting more leisure in its completion. However, if this class of work reaches the week in which it is to be completed, it automatically becomes an "at once" order.

When a request is made for a part that may require a duplicate at a later date, an order is placed for a quantity sufficient to fulfill the requirements for six months to a year. The amount, estimated by the master mechanic, is based on the usage in former years. This feature reduces the cost of the unit, in that the set-up costs are spread over the number of parts ordered. Care is taken in the amount of such material ordered, so that the stock inventory will not be excessive.

A request for a repair part is made by the superintendent of the department desiring it on the form shown in Fig. 1. The date ordered, the date required, the part wanted, and the department it is for, are listed by him, after which the order is sent to the mechanical stores department. If the part is on hand, it is delivered from stock, and the order is marked accordingly by filling in the account number, the card number, the balance on hand and the order number. If the part is not on hand, a shop order, such as shown in Fig. 2, is made out by the mechanical stores department to make the part wanted. A copy is issued to each department affected, such as the foundry and the blacksmith and machine shops, another copy is sent to the originator of the order, and a final copy is kept by the chief clerk. If a copy is sent to the pattern shop, it is an authority to make a pattern if one is not on hand.



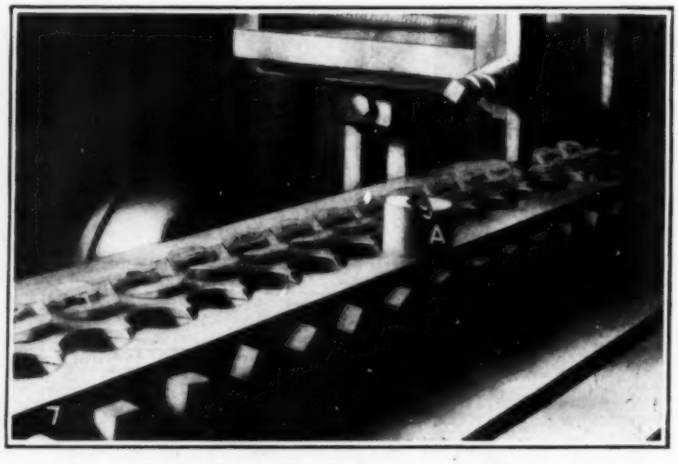
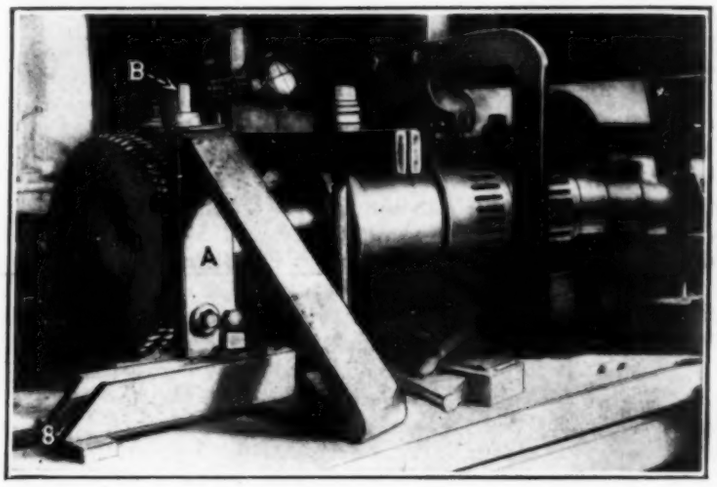


Fig. 6—Rear view of cam turning fixture. *Fig. 7—Planing the contour of a group of dies*



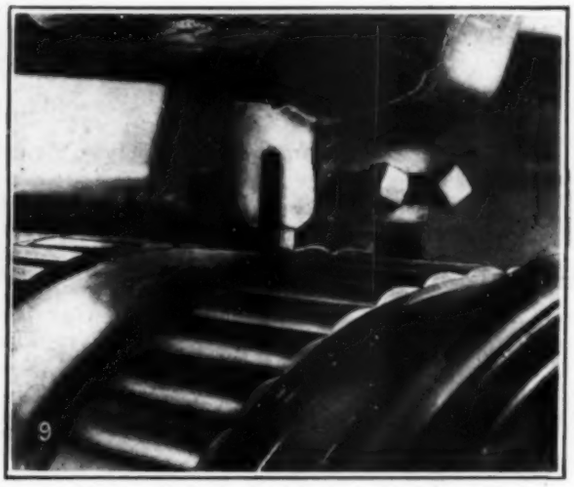


Fig. 8—Indexing arrangement for planning washboard tie-plate rolls. Fig. 9—Close-up view of tool for cutting corrugations

When the machine shop receives its copy of the order, the form shown in Fig. 3 is made out, which records the individual operations to be performed, the jigs or tools to be used, the machine numbers, and the estimated time allowances. At the right-hand side is recorded the dates the work is received and completed. Comparative time costs are obtained from the operators' time slips.

Due to the severe service steel-mill machinery undergoes in use, the majority of the machined parts are of heavy construction, usually being made of cast steel. The machine-tool equipment of the shop to handle such parts consists of heavy-duty lathes, boring mills, planers, shapers, radial drills, turret lathes, and gear cutters. A toolroom is maintained for making miscellaneous dies and fixtures. All work is laid out by one man at a central point. The layout table is unusually heavy in construction to accommodate the general run of work. In Fig. 4 is shown a spreader for a bloom table being marked for the miscellaneous machining operation. The top and the bottom faces have been planed and then coated with a mixture of benzol and white lead, so that the layout marks will be visible. Such work is handled in groups when possible to insure uniformity and to reduce the layout time.

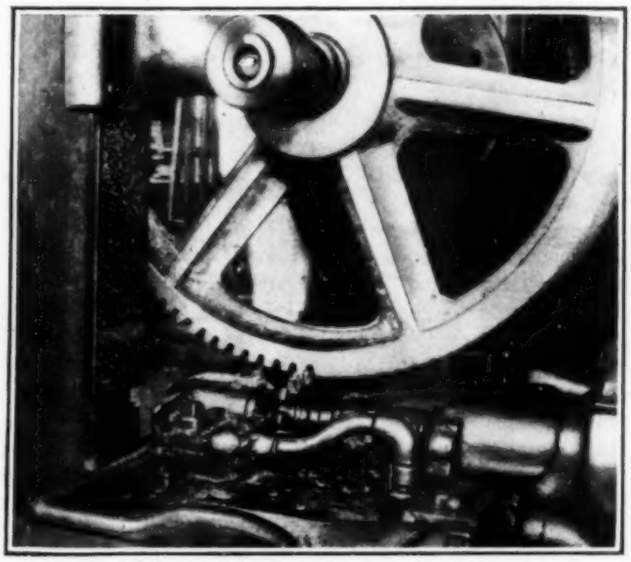


Fig. 10—Cutting the teeth of a cast-steel spur gear

Several cams are required for the wire-mill machinery, and in Figs. 5 and 6 may be seen the equipment designed for producing them. The cam is mounted on a mandrel having a spur gear *A*, Fig. 5, attached to it as shown, and which is driven by the machine spindle. To the rear of the spindle is mounted an idler shaft to which is attached the master cam *B*, Fig. 6, and a mating gear of the same size as the one on the mandrel. The toolblock of the lathe, from which the feed screw has been disengaged, has a weight fastened to it so that a roller, also fastened to the toolblock, will bear against the master cam. Movement of the toolblock is controlled by the master cam so that the cutting tool machines the work accordingly. After the roughing and finishing cuts have been taken, the cams are hardened and polished.

Dies are made in quantity lots in accordance with the quantity used. In Fig. 7 is illustrated a gang set-up on a planer for machining the contour of tie-plate dies. The work is held in a fixture that accommodates 90 pieces in two rows. Each row is arranged for different sized dies. They may be machined together or separately according to the amount on order. A finished die is shown at *A*. The top face is completed in two cuts, the final cut being taken by a formed tool.

"Washboard" tie-plate rolls have two sets of corrugations located around the periphery, being separated by a collar that prevents both sets from passing under the tool in sequence. Therefore, one set is machined at a time. Fig. 8 shows the set-up used. The work is supported and clamped in two V-blocks located on a planer table. On the front end of the work is mounted a wormwheel that meshes with a worm located in the upright member *A*. The work is indexed by turning the shank *B* of the worm. A pointer records the correct location. In Fig. 9 is shown a close-up view of the forming tool. The work is indexed one space at a time until the 46 corrugations have been completed. A profile gage is used to check the contour of the cut.

Cut gears are used whenever possible, therefore, several gear cutters have been installed to accommodate the work. In Fig. 10 is illustrated a 3-pitch, 5-in. face, 100-tooth, cast-steel spur gear, used in a rail-mill conveyor, having its teeth cut in an automatic machine.

What's the *Odds* in Machine-Shop Management?

By Louis C. Gambone

THERE are certain precepts that apply so vividly and are so basic in their nature that they are oft overlooked, or slighted, in the rush of modern competition in the machine-shop industry. There is nothing very new about these precepts, but it is intended to develop them each in turn to their proper magnitude, and then combine them into a phrase whose initials furnish that peculiarly emphasized word in the title of this article. In this way, it is hoped to impress them so concretely on the memory, that the possibility of their being slighted is greatly minimized.

Organize! That's the very first step, before a single lathe is caused to revolve in the new shop by the mere throwing of an electric switch. It sounds rather dogmatic to insist so positively on priority, but there are too many manufacturing plants, scattered throughout these fair United States, struggling to overcome the handicap of a start without proper organization, to do otherwise. To attempt this after the plant is running, means reorganization, and that unfortunately always costs money.

Now what do we mean by organize? First, no matter how much you know about the practical operation of a machine shop, consider finances. Talk them over with your local banker and analyze with him your prospective markets: both for product and for labor. Find out just how good your credit as a firm will be. Remember the limitation he puts on your credit is no reflection on you personally, but it merely reflects his business judgment as to the prospects of your enterprise. It is infinitely better to deal frankly with your banker before you start than to vaguely expect him to be a "fairy Godfather" if the rocks threaten your business craft sometime in the future. Concurrently you should be planning the type of work you propose to handle. Of course, if you already are planning to manufacture a definite product or line of products exclusively, that restricts you to a definite program. But, if you are planning to do jobbing or contract work, don't just figure on doing anything that comes along without giving it considerable thought beforehand. If you are not to be the sole owner of the proposed business, be certain to see your lawyer so that you will be properly organized according to the laws of your state. Matters over which you have absolutely no control affect relationships adversely at times. Regard proper legal organization as trouble insurance. Consider markets as part of the organizing phase. Many factors influence the selection of your actual physical site for transacting your proposed business, but of considerable moment are these: accessibility of raw material market, convenience to market for your product, availability of your specialized labor market, adaptability of your local site to the anticipated tendency of industrial growth.

Separate the Duties

Divide! When you have brought together many factors and individuals to create this new business, it is well to divide it, if only tentatively, before habits and customs make it a real hardship to do so. Divide it into distinct departments. This is essential, for without some such subdivision, you cannot properly check costs nor place responsibilities. Many a manufacturing plant carries along a weak limb that has never paid for itself, but merely absorbs some of the profit-giving sap of a stronger branch. Unless the plant is properly divided from the very beginning, so that accounting figures vividly point out this dry rot, it may go on undetected for years, until it destroys the entire business. Division should also be made applicable to individuals, so that each one knows exactly what his duties are and what is to be expected of him. Many a costly slip up, traceable solely to Bill's thinking John was taking care of it and vice versa, can be avoided by proper division of duties. In large organizations, written manuals defining each department head's duties and responsibilities are often of great help and fully warrant the cost of preparation. Division is the only way to properly control overhead. Distinct divisions, each carrying its own overhead as well as a portion of the general administrative overhead, shed much light on the ramifications of that particular bugaboo of modern industry. Properly dissected, overhead is not nearly so formidable an antagonist as when it is all bound up in a most mysterious manner with the very roots of the business.

Be Fair with Subordinates

Deputize! Now we come face to face with the human problem. Use every means at your command to select men in whom you have every reason to place confidence, and then place it. Don't give a man a half-hearted responsibility, so that he can hardly feel a sense of personal credit for successes, yet is certain to be blamed for failures. Be fair with him and put him on his own, to make or break on his own initiative in carrying out his assigned duties.

This becomes increasingly important as the size of the business grows and you must delegate authority. A good start makes a success of many a man who would otherwise hardly be more than a mediocre worker, and it is up to you to give him that start once you have selected him. Let him know you believe in him, and if he is at all worthy of his position, he will reflect the confidence you place in him in his activities on your behalf.

Delegate the Lesser Duties

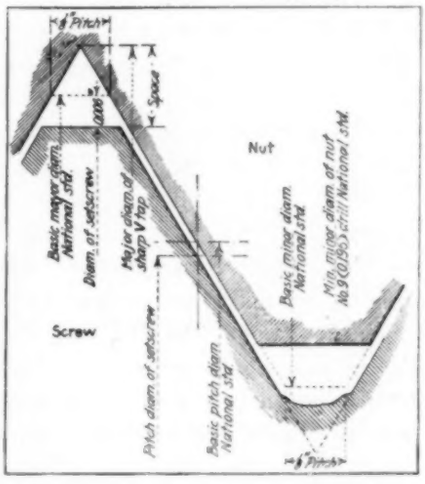
Supervise! All the preceding points really have had to do with the inception of the business, but this one has to do with the successful continuation of it. To properly supervise calls for personal discipline; you as well as the men must recognize the established lines of authority, and you as well as they must function according to them. Proper supervision eliminates trying to handle all the many small details personally, and when they do come to your attention, they should be turned over to the proper department head. Supervisors should avoid all routine duties and those that can safely be delegated to others. They should concern themselves only with unusual conditions or emergencies and should study existing forms of organization for the purpose of improvement and simplification. Supervisors should originate ideas and provide the means for carrying them out, but should not actually carry them out step by step. In a properly organized concern, the chief executive should concern himself chiefly with breaking the rules to meet emergencies or unusual conditions.

Now, if we combine all four of these phases into a single phrase we have: *Organize, divide, deputize, supervise,* and therein lies the essence of success of most successful plants. Taking their initials in order, we get *odds* and truly they answer that question, "What's the *odds* in machine-shop management?"

Why Discard the V Thread?—Discussion

By Andrew J. Schwartz

IN AN article by E. C. Herb, under the title given above, published on page 52, Vol. 66 of the *American Machinist*, it is inferred that an airtight fit was desired to be made with a screw thread and that this was accomplished by the use of a sharp V-thread tap. It is not stated in the article just what is meant by the word "snug" and therein lies one of the troubles in obtaining a tap, for no dimensions are specified and every manufacturer of taps and screws has his own interpretation of the word "snug." All such terms should be discarded and the required fit specified in figures giving the permissible tolerances. It is evident that the fit of the ¼-in. setscrew was a very important consideration in the high-speed machine and therefore, as so much depended on the screw remaining tight, a set of "go" and "not go" gages should have been provided; but how is the gage manufacturer to make gages to a "snug" fit when no limits are given?



Comparison of thread elements

According to the Tap and Die Institute and the National Screw Thread Commission, a ¼-in. tap should be 0.003 in. above basic diameter, therefore the tap in question being 0.006 in. above basic should have been rejected; but it is not clear why the tap should be discarded for the sharp V-tap in order to obtain a snug fit. As noted in the American Engineering Standards Committee report, B1; and the National Screw Thread Commission report (Bureau of Standards publication No. 61), the fit of a thread is not dependent on the major diameter of the thread in the nut and screw, but on the flanks of the thread, and it is governed by the pitch diameter. The statement that the screws were 0.004 to 0.006 in. undersize would place them in the 2, 3, or 4 class of fit and, as far as the major diameter is concerned, these screws would be considered excellent, the other thread elements being equally good. For some of the readers of the *American Machinist*, the information is given that the old titles of U.S.S. (United States Standard) and S.A.E. (Society of Automotive Engineers) are obsolescent and should not now be used in ordering screws and taps. The new designations are the "National" coarse thread and the "National" fine thread respectively. These designations have been accepted by the Federal Government, the General Motors Corporation, and other large users of screw thread products.

No mention is made of the size of the ¼-in. tap drill used for the ¼-in. 20-thread tapped hole, but since tap breakage should be kept at a minimum, we will assume a No. 9 drill (0.196 in. diameter) was used. A No. 7 (0.201 in. diameter) would be better for elimination of breakage. We will also assume that the sharp V tap has a basic pitch diameter in order to cut the minimum major and pitch diameter in the hole, and the thread shown in the illustration is laid out accordingly. The heavy dotted lines at the major and minor diameters show the basic size given in the National Screw Thread Commission report. Mr. Herb's article states in paragraph 2 that the screws were 0.004 to 0.006 in. undersize, yet in the last paragraph we are led to believe that the screws were U. S. Standard. The screws referred to in paragraphs 2 and 4 were not U. S. Standard, because they were 0.004 to 0.006 in. undersize in the major diameter, and they would fall within the class 3 fit as the illustration shows.

If a very special fit is required in a machine screw thread, then both the tap and screw should be tested by a screw thread comparator for error in lead, pitch, major diameter, minor diameter, pitch diameter and angle of thread. In addition, the hole should be tested with "go" and "not go" gages. It is not necessary to depend upon an out-of-date sharp V tap to insure the desired fit.

I believe that it will be evident from an inspection of the illustration, which shows the large space at the major diameter, that the question, "Why Discard the V Thread?" should be changed to, "Why Use the V Thread?" when a particular fit is desired.

Employee Magazines that Go Home

HOME influence on the morale of the personnel is a larger factor than many realize. Nor does this imply that no one but a Mr. Henpeck can be affected by such influence. Managers of large numbers of men, who cannot if they would, keep in personal contact with all their employees, realize how much depends on the home conditions to keep a man contented. For this reason one of the first aims of an employees' magazine should be to reach the home. Some concerns even go to the expense of mailing the magazine to the home instead of distributing it in the shop.

When the magazine is of sufficient interest to attract the wife it is easy to explain the reason for changes in rules, hours or other conditions, which might otherwise cause dissension. By making the home side of the family see the benefit of safety campaigns and safety precautions, it is usually much easier to induce men to wear goggles and to exercise more care than they otherwise would.

Interesting the woman also frequently helps the man's status at home. Illustrations that show the kind of work he does and a few words about the accuracy required, makes him more important in the eyes of the family. Instead of being just a machinist who gets his clothes very dirty at times, he becomes a really important factor in the shop's output.

THE · FOREMAN'S · ROUND · TABLE

Looking Beyond the Department

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"SUFFERING cats, Al, I sure got caught today without my headpiece screwed on. Guess my stock in the company has gone down a peg, all right."

"What's gone wrong now, Ed?"

"You remember Williams said the big boss was due for a trip around the works? Well, he came today. I was all primed to show him the details of the department, and our plans for big production work, but everything went fluey.

"Instead of coming in tow of Williams, he kinda pushed his own way into all the places; and gosh, he made me see things I sure have been overlooking. Talk about the 'ask me another' questionnaires, they've got nothing on him. Asked why the two disk grinders were standing idle; said they could get work that would keep those machines busy if I would only report on the idle time.

"Then he asked me why I didn't request the engineering department to make those body castings with center-relieved face to save having to plane all that metal off the big surface.

"Felt like a fool that I didn't think of those things before, but that's not the worst. Just as he was going out he asked me confidentially-like what I thought of the company's new advertising campaign."

"What did you tell him, Ed?"

"That's where the rub came. Told him I read two or three trade papers and kept up on the new things put out by our competitors, but didn't pay much attention to our own ads. What does he think a foreman is, anyway, Al, a walking encyclopedia on the business?"

"No, I don't think so, Ed. Looks reasonable to me, and I see where I better get busy myself. Looks like the Big Boss wants a foreman to look beyond production in his own department, and bring out the points where profits can be made by co-operation with other departments. Things like putting new jobs into the idle machines, and suggesting changes in design that help production, look good to me, Ed. Then, I think we all fall down on that advertising idea, Ed. Don't the foreman know the product better than the ad writers, and couldn't we hand up a suggestion once in a while? Wonder if we shouldn't interest ourselves more in the general policies of the firm?"

Was the Big Boss right in looking for things going wrong rather than seeing the things going well?

Should a foreman interest himself in cost and design?

Is the foreman interested in the finished product of the firm?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Should the Shop Govern Purchases?

A SALESMAN comes along with a cheaper grade of steel for tools, a cheaper grade of steel for machining, cheaper materials of all kinds used in shop work, and with it a good line of talk, the purchasing agent figures the initial cost, but the shopman figures the life of the material, the adaptability to its particular requirements and uses. As he is the only man that has this first hand information, he should then be allowed to consult with the purchasing agent, salesman, and if necessary, the management, so that his knowledge can be worked in with the initial cost as comparison. Money saved in the purchase of materials is very often lost, and the cause of great expense after it reaches the shop. A grade of tool steel that will not stand up under the work means frequent dressing, meaning the loss of time for machine hand, idleness of machine, time of the tool dresser, as well as loss of time of the machine trying to do work with an inferior tool. A poor machine might ruin a piece of work when it is nearly finished, which means a large loss of time and labor. It might cause a serious accident owing to not being built to withstand the work required. Money saved on a cheaper grade of oil might mean a ruined bearing, causing a loss of time and labor. The shop superintendent or any other head concerned in the use of any material should be consulted, and the knowledge of his experience should help govern the purchase of material used in his department.

—H. M. CROOKS, *Master Mechanic.*

AN EFFICIENT manager will see to it that his purchasing agent keeps in close touch with the shop so that unsuitable material is not purchased, or if once purchased the error be not repeated. Probably the best means of accomplishing this is to see that no significant change is made in the source of supply or in the grade of material purchased without consulting the shop.

In the case of castings and forgings the purchasing department is often inclined to accept the lowest price given on a pound basis, in which case it is likely the supplier may use every means he can to increase the weight. The result of this is that the price per piece may be greater than formerly, besides the extra cost of removing the superfluous metal.

In most up-to-date organizations the purchasing agent is usually a high grade man with a reasonably good knowledge of shop practice and conditions in addition to a knowledge of the market. Nevertheless, one who knows how to obtain maximum efficiency will not scorn to take advantage of the shop point of view, and of the services which the inspection department can render. If not, a wideawake general manager would soon have him in line for a "bawling-out."

—STEPHEN C. MILLER, *General Manager.*

Al and Ed have been discussing their baffling problems for the past year, to which have been added the ideas of more than two hundred readers of the "American Machinist." In the next issue the editors will analyze all of this discussion and present the outstanding conclusions and answers to these foremen's problems as reached by the contributors during this period

Getting New Blood in the Shop

A GOOD organization is one that has men being drilled at all times for the jobs higher up. I would want the men of ability to be able to represent my company in character as well as production, both in the shop and out. A foreman should be a man who has the ability to command the respect of associates in everyday life as well as in the shop. It should give a great deal of pleasure to a manager to have it said of one of his foreman, "That is one of Mr. So and So's assistants." There are so many points that should be considered in selecting a foreman that it is surprising that there is not more effort on the part of the management to build the foreman from the material to be had in any factory. A man's home life has a great part in his ability as a foreman. How many men who hold responsible positions ever think what a detriment to the man and the company by having one of his workmen in a troubled state of mind? If a man is given a severe lecture, or a threat of his position, and allowed to go home with this feeling, he and his family suffer, and you can imagine the state of mind he will be in for the next day's work. The proper kind of foreman will find out the cause, assist the workmen to correct the error, and will not let the workman leave the place without some word of pleasantry, so that the man has the feeling of having corrected a deficiency. The manager who educates his men properly has not merely foremen, but a crew of managers with ability to step up, and with men under them capable of stepping into their shoes.

—J. R. HARRIS.

WHEN it comes to making a decision on the question of selecting a new foreman, it is in nine out of ten cases a safe bet to get a man from the outside. Cliques abide in most shops, and it is not uncommon to find shops that are dominated more by internal politics than by the men who should assert their authority. This is perhaps the one important reason why many managers look outside for a new executive when they find it necessary to get rid of one who is too full of shop politics.

The new foreman will stand a better chance of get-

ting along well with the gang than one who has been in intimate daily contact with them for a number of years. The old foreman may have been a favorite with the men, and the man who takes his place, if an insider, will often be accused of playing politics to get the place. In such an event the insider will not find the job of being foreman a bed of roses. Anyone who has ambitions to be a foreman might better try to test his ability in a strange shop.

—H. L. WHEELER.

IT SHOULD never be necessary to go outside a shop for a foreman, except under very exceptional circumstances. Under ordinary conditions it will show a lack in the management to be without a suitable man for foreman. Bringing in an outsider will affect some men more than others. If there are any ambitious ones they will naturally be disappointed, and will be on the lookout for a chance somewhere else.

—H. MAPLETHORPE, *England.*

Should the Foreman Get a Bonus?

THE bonus for foremen does increase production if it is applied to the only cases where it is to my mind applicable, namely, on straight production work. In this instance, the foreman is like a salesman in that his usefulness can be measured by his results, which are units of product per man per machine.

A primary objection would be the tendency of the foreman to over-equip his shop, to demand the best grades of material and tools, in fact, to fight for anything that will increase production, without due regard to the ultimate cost. If the shop is attempting to carry on special work at the same time, it is obvious that this will suffer by comparison with the straight production work. There might also be a tendency to regard the machines in terms of today's production only, with a consequent lack of attention, which would shorten their useful life. Where development and special work enter into consideration, I believe a straight salary will secure a better balanced interest. —G. J. MAHON.

IT IS up to the foreman to see that his operators do their utmost, and if there are any bonuses given, the foreman should share them; and it will give him a greater incentive than any matter of ethics. If there is any doubt about the reliability of a foreman, it might be well to install a time clock, but for the average foreman it is not needed. A man will give more extra time at no cost to the company more readily without having to account for his time than if he is obliged to punch a clock. —B. C. THOMAS.

PLACING a foreman on a bonus is likely to create unsatisfactory results, driving his men to a point where they cannot stand up under the strain, creating in them a dislike for the foreman and the company and a general dissatisfaction that would be a detriment to himself and the company, starting a turnover in labor which is always costly to any concern, giving the company a bad reputation as an employer, or it might cause the foreman to allow the work to drop below standard in order to increase his earnings. It is human nature to find fault with conditions, and where could be found a greater incentive for the workmen to find fault than to feel that their efforts were a gain for the man who is driving them?

Giving the foreman a straight salary large enough to keep him interested in his position, and to keep him striving for the next position higher up, is a much better plan. He will act as a balance wheel in keeping the work turned out up to a standard, will give his men every assistance in increasing their production and earning power, and will create in them a respect for himself and the company he represents.

—H. M. CROOKS, *Master Mechanic.*

BOTH Ed and Al overlooked some of the major difficulties in a fair bonus plan for foremen. The ratio of non-productive to productive workmen is also an important factor in any bonus scheme for foremen, as otherwise a foreman would increase his overhead labor in order to increase his unit output per man engaged on production. On the other hand, if the bonus paying output is based on the total force, there is a tendency to put everybody on production, and neglect all other matters. Neither extreme is correct, but a fair balance between, which should be made a factor of the foreman's bonus, is the proper solution.

Waste is another important factor in any foreman's bonus scheme. Increased production, unless it is carefully watched, may be nullified by increased spoilage. Therefore spoilage should be made the third factor in the bonus system for the foreman. With the three factors combined into a bonus scheme, there is every reason to expect it to be successful. —J. B. FLOWERS.

How Do Mutual Aid Societies Help?

NECESSITY for concentrated effort on the training of foremen was recognized by our company five years ago. They understood that the foreman is the keystone to the organization, and if properly trained will eventually bring success to the business. They encouraged all of us foremen to attend a foremen's class held on company time, conducted by the Division of Vocational Education of the Cleveland public schools one morning each week.

For the past two years we have not needed the services of the vocational education instructor. We secured a list of topics, the class chairman assigning one of the subjects to a different member each week. This member has an entire week in which to prepare himself, and he usually comes with ample material to provoke a general discussion.

It is just as essential for foremen to get together for a mutual discussion of problems that are common to men and management as it is for doctors, lawyers, bankers, or any other professional men to have their group meetings, clinics, conventions, banquets, or whatever term may be applied.

Now Ed and Al, I want to tell you something about our club. It is the business of our foreman's club to develop friendly relations between our foremen, their wives and children, so that our social life and interest

extend outside of the building and permeate the home life of each one of us, resulting in a co-operative spirit being developed to a very high degree, and giving a great liberty and freedom of expression among the 24 members of the class and club.

—W. S. BATEMAN, *Foreman.*

IN THE discussion of the advantages of the mutual aid society for providing funds in the case of sickness there has been no mention of the type of society known as the sick and annual, that is, a mutual society which provides benefits during sickness and at the end of the year distributes any surplus equally among the members. This type of society has the attraction of the something coming back, which gets men to join and keeps them in. In the bad years, the extra expense is carried without it being noticeable, while in the good times the returns form a pleasant surprise.

One such society which has been running for over 25 years pays out during sickness, or accident requiring the men to knock off work, a sum equal to 28 times the weekly contribution for a period of 8 weeks, and 14 times the contribution for a further period of eight weeks, as a maximum benefit for any one year. The average return at the end of the year has been 36 contributions, last year it was 42. The membership has varied between 50 and 150, and the apprentices pay half the amount of a man's contribution and receive half the amount of during sickness.

—ALBERT F. GUYLER, *England.*

Hiring Back the Fired Workman

THE function of a shop foreman, primarily, is to see to it that a proper rate of production is obtained in relation to the number of workmen under his supervision. In order to accomplish this a number of things are necessary: He must understand the work himself; he must be impartial and play no favorites among his men, if he would gain and hold their respect; and he must maintain discipline which is easy if he has the confidence and respect of his men.

A workman may back fire on many points. If he is a valuable man, the foreman will call him on the carpet for a heart-to-heart talk, which will result in one of two things, either he will see the light and mend his ways, or make up his mind he is too important to be discharged, continue his transgressions, and be discharged in the interest of discipline.

Many really good men have done things tending to the disruption of a shop organization, for which there was no other course open except an immediate discharge, and yet have come back to that same organization after an enforced absence, and have given no further trouble. Al demonstrated his good sense and fitness for his position by hiring Grogan back. —ROBERT TAIT.

IN PRACTICALLY every organization there is to be found a Grogan, but men of Al's calibre are exceedingly rare. If there were more Als there would be fewer Grogans. It is quite evident that Al belongs to the new order of things, and as a valued foreman possesses at least two most essential qualifications: A knowledge of what constitutes a good mechanic, and that more valuable asset, the ability to fathom human nature.

Then, too, Al showed himself to be a big, straight-thinking man by his willingness to sacrifice personal feelings for his company's interest. He realized that Grogan's skill was an asset to the company, and although he had the influence and authority to prevent his return, he did not exercise any ill will he might have had against the man.

It would have been extremely unwise for any foreman who did not possess similar traits of character to have taken Grogan back. Working under a man lacking these, Grogan always would have felt ill at ease, and in consequence could never have regained his former efficiency. Al possessed those peculiar qualities which proved convincingly to Grogan that the past was forgotten, and he was able to return a changed man, and even a better workman. Men of Al's type can bring the discharged man back; all others had better no attempt it.

—CHAS. MANN ROSE, *Superintendent.*

Should the Shop Govern Purchases?

THE decision as to what materials should be bought should be a joint one between the shop and the purchasing department based upon their combined knowledge, because neither one nor the other can have full knowledge concerning the transaction. A low first cost, if it increases the total cost, is not a saving.

Sometimes there is too little co-operation between purchasing department, shop, and design department. The purchasing department has catalogs of great value to the designers, which are inaccessible to the latter. The scarcity of catalogs and advertising matter in many design departments is astonishing. The advertiser who first concentrates on getting his matter into every design department will reap a reward in substantially increased business. —JOHN WOFFINGTON.

NOBODY would deny that the shop should know the class of materials that can be machined the cheapest. The purchasing department should know where that material can be bought cheapest, and also have some suggestion for other materials that might do. There are always plenty of salesmen who have something cheaper that is just as good, and once in a while it is.

If the shop and the purchasing agent are both satisfied to try a new and cheaper material, here is something to be passed upon by a third department, as it may have a bad effect on future sales. The shop wants materials that will give it the least trouble; the purchasing department wants to make a showing on low material cost, while the salesmen and the directors want high qualities, low selling prices, and big profits. When the "old boss" took off his overalls and went into the office he naturally did the purchasing. He was an ideal person to do it, for he combined in himself the various departments referred to. When he delegated his purchasing authority to someone else, his authority but not his wisdom went with it. A direct answer to the question of who should designate the class of material to be purchased is, of course, neither of the two departments. They must do it together. —R. L. KING.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Drill Jig for a Lever of Unusual Shape

BY EDWARD T. HEARD

The jig, Fig. 1, was designed for drilling the lever shown in Fig. 2. The rough fins were removed from the lever and the faces of the boss at *A* were milled to dimensions previous to drilling.

The jig consists of the base *B* fitted with feet *C* and *D*, and with V-blocks for locating the work; also the necessary bushings for guiding the drills. Lugs integral with the base, are finished to the dimensions of the thickness of the boss *E* of the lever. The V-block *H* is cut away to allow clearance for the arm *J* of the lever. The opposite end of the lever is held by the adjustable V-block *K*, having a tongue to fit the splayed end. The adjustable V-block slides between the finished faces *L*, and is operated by the screw *M* by means of the hand knob shown.

Bushing *N* is pressed into the base and is flattened on the sides to clear the adjustable V-block. The other bushings are of the ordinary type. The lever is clamped by advancing the adjustable V-block.

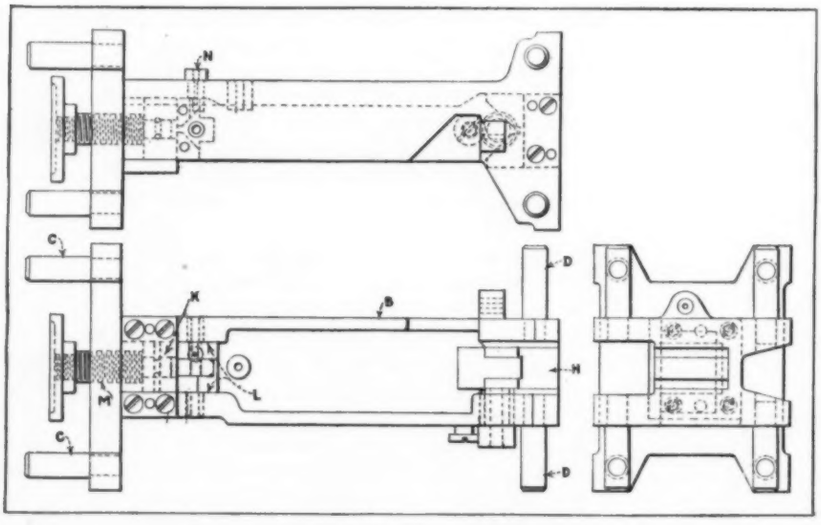


Fig. 1—Drill jig for an odd-shaped lever

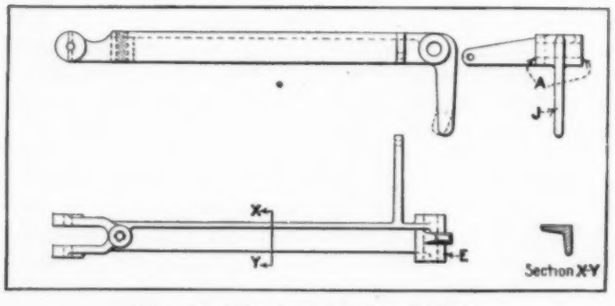


Fig. 2—The lever to be drilled

Grinding Thin Gage Blocks—Discussion

BY HERBERT BROWN

Grinding thin pieces of hardened steel to make them flat and of even thickness, as described by H. J. Gustav Kopsch on page 942, Vol. 66, of the *American Machinist*, is a very difficult and exasperating job, and the trouble is all due to the local distortion of the steel under the heat generated by the grinding wheel. I will tell how I saw some pieces, much thinner, even, than those upon which Mr. Kopsch experimented, ground flat and parallel without great difficulty.

Quite a little preliminary work was required, but it was well expended. A new alundum grinding wheel 6 in. in diameter by $\frac{1}{2}$ in. thick, grain 60, grade I, was selected and was beveled back from the periphery on both sides until its effective width was not more than $\frac{1}{8}$ inch. The lead bushing was taken out, the hole rounded up as true as possible and a square notch, like a keyway, cut in the bore.

A special, headed bushing and collar were made to hold the wheel. The diameter of the body of the bushing was made a free fit in the hole in the wheel and its bore was reamed to fit the spindle of the surface grinding machine. The outside diameter of the collar and of the head of the bushing was about 3 or $3\frac{1}{4}$ inches, large enough to take the place of the regular wheel collars. The loose collar was splined to the bushing, the same spline fitting the notch in the bore of the wheel.

The especially peculiar feature of the bushing lay in the fact that its face—against which the wheel was to be clamped—was not square with the axis but was inclined to an angle of 10 degrees. The corresponding face of the loose collar was, of course, disposed at the same angle; hence the spline was necessary to prevent the angular faces of the bushing and the collar from getting out of parallel.

With the bushing, wheel and collar in place on the spindle of the grinding machine and all parts clamped firmly by the regular nut, the wheel occupied a position 10 deg. from a true plane and, when started, "wabbled" very badly; in fact it wabbled so much that the regular wheel guard had to be replaced by a special one. While running, the periphery looked to be about 1¼ in. wide, but presented a sort of hazy appearance; in fact one could see right through it. It was promptly dubbed the "phantom" wheel.

In this condition the periphery would have touched the work only at two opposite points. The next move was to place a diamond holder on the magnetic chuck and "true" the wheel. This had to be done very carefully, and when completed and the periphery of the wheel was of equal radius when considered as a true plane, the wheel itself was actually elliptical in shape. This was why the wheel as well as the collar had to be splined to the bushing, and the truing process had to be repeated every time the wheel was replaced on the spindle.

This scheme worked very well so far as the absence of heat was concerned and enabled very thin pieces to be ground quite flat, but it could hardly be considered a rapid production method, since it was necessary to disregard the mechanical movement and traverse the table slowly by hand. On a piece 1 in. wide, no cross-feed was required, as the wheel would grind more than the full width without it.

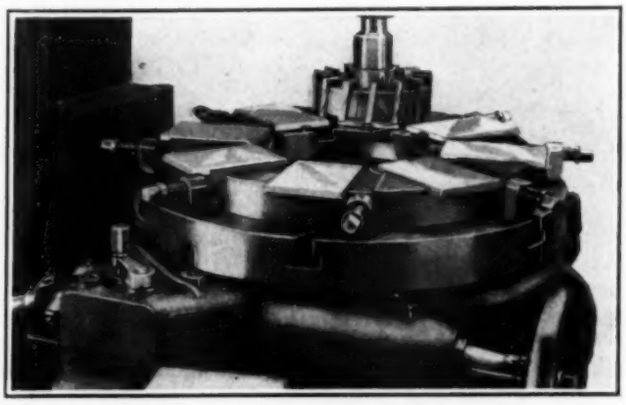
The grinding action—far too rapid to be followed by the eye—consisted of a series of strokes across the work, forward and back, at a right angle to the line of advance of the table, and distributed the heat evenly over the work instead of allowing it to build up in a little spot directly under the wheel. While it was slow work it was also satisfactory. The pieces were ground flat in time, while by the regular method they could not be gotten flat at all.

A Simple Milling Fixture

By Paul Armstrong

When the shape of a piece of work lends itself to the operation of continuous milling the number of pieces wanted does not have to be very large in order to justify the expense of a fixture for the purpose. The illustration shows an example where some flat castings having beveled sides were to be machined.

The fixture itself is no more than a flat ring with eight broad, shallow grooves with dovetailed sides, extending radially across one flat side. The dovetail in one side of each groove is formed by a taper gib.



Continuous milling fixture for flat work

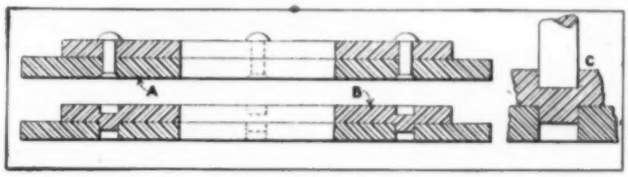
Though the opposite dovetailed sides of each work-holding groove are parallel to each other when the gib is in place, the taper gib causes it to grip the work as it is pushed toward the center of the ring by its screw.

Each work-piece abuts against the head of a screw plug that is sunk into the bottom of its groove and is thus prevented from moving endwise when tightened by the gib, though such displacement would do no harm unless it were sufficient to move a portion of the work-piece out of the path of the milling cutter.

Press-Assembling Flat Stampings

By Frank Waldo

In assembling two ⅛-in. sheet-metal stampings used in connection with a calculating machine, the joint was made by rivets as shown at *A* in the illustration. Each stamping contained four pierced holes equally spaced around a central hole, so that the parts would match



Slug-assembling two stampings

when rivets were inserted. A good joint was obtained, but the insertion of the rivets and the riveting operations required delicate handling.

By revising the method of assembly as illustrated at *B*, a reduction in cost was made which included not only less handling time but also the omission of the rivets. Only one stamping has the four small holes punched in it. Both parts are placed in a die so that the pierced stamping is underneath. The alignment of both parts is obtained by a plug fitting the central holes. The pierced stamping receives its location from a small pin that fits into one of the pierced holes. The height of the locating pin is just sufficient to enter the hole, or approximately one-quarter of the thickness of the stamping. Four punches in the ram of the press push an equal number of slugs from the upper stamping into the pierced holes of the lower stamping. The movement of the ram is limited so that the slugs will enter but half way into the bottom holes. At *C* is shown an enlarged view of the assembly with one of the punches in place. The principle utilized is similar to any punch and die, with the exception that the holes in the lower stamping act as dies.

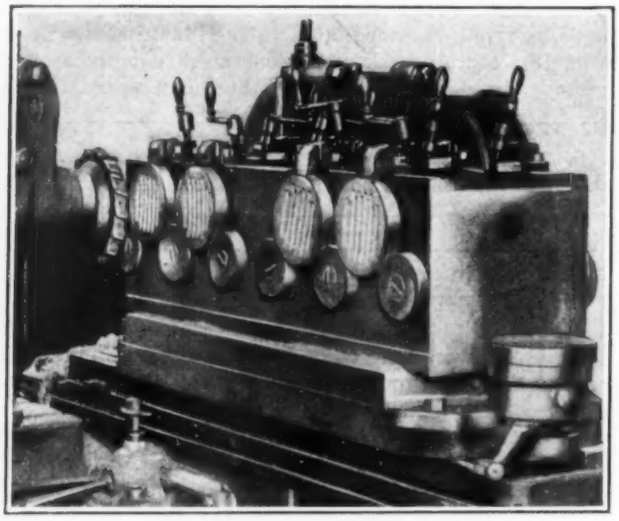
In assembling work of this nature, when the material is ⅛ in. in thickness or less, the diameter of the punch should not be smaller than the thickness of the stock. For thicker material, the diameter of the slug can be judged from usual punch and die practice. If desired, the bottom stamping can be located on four buttons, or as many as there are holes to be joined, so that the slugs will strike the tops of the buttons and cause a swaging action. If this procedure is followed, unusual care should be taken in adjusting the stroke of the press, and a clamping device or pressure pad should be used to hold the stampings together so that they will not separate when the swaging takes place. One factor to

consider when assembling the parts, is the flat and the round sides of the stampings produced by the blanking die. A better joint is made by assembling the flat sides together, although a flat and a round side can be matched satisfactorily if the edges are not distorted or too rough; also when one part overlaps the other so that the round edge projects beyond the edge of the smaller stamping.

Double Milling Fixture for Valve Disks

By Charles F. Henry

The illustration shows a milling fixture used on a double-head Cincinnati automatic milling machine in the plant of the Worthington Pump & Machinery Corporation, Elmwood, Cincinnati, Ohio. The fixture consists primarily of a substantial box frame having the



Fixture for facing valve-disks

sides and bottom machined. Six steel disks mounted on each side of the frame act as supports for the valve disks as shown.

The valve disks are placed flat against the machined surface of the fixture, and rest on two of the supporting disks. The disks to be machined are held in place by means of clamps, the action of which tends to draw them against the side of the fixture. The opposite side of the fixture is a duplicate of the side shown in the illustration, so that eight valve disks are in place at one setting and are surfaced at one pass.

The cut can be started as soon as two disks, one on each side of the fixture, have been clamped in position. The six remaining disks are loaded while the cutters are at work on the first two. Likewise, unloading can be commenced as soon as the cutters have passed the first two disks, thus making the operation almost continuous.

A "falling fit" is what some call the fit of a piston pin that will just drop into the bearing in the piston of its own weight.

Reamers have been improved until they give excellent results. But many still feel that the single point, or fly cutter, will bore the straightest and truest hole, and use it for finishing bearings or bearing seats.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Preventing Adhesion in the Lead Bath

Q. We are using a lead bath for heating tools and parts for hardening, and have experienced considerable trouble lately from the sticking of the lead to the steel. This is particularly annoying on tools of complicated shapes where the lead gets into the crevices. How can we avoid this trouble?

A. Pure lead will not stick to the steel, and it would appear that your trouble is from impurities in the bath. Look carefully into the source of your metal. If you are melting down old lead, it is very probable that there is some tin or zinc, or both, in the bath. These metals will stick to the steel tools.

The trouble may also be with the oxide, or dross, formed in the bath by exposure of the hot lead to the air. This dross will stick to the steel and cause great inconvenience. It can be prevented or kept down by covering the top of the bath with a layer of charcoal.

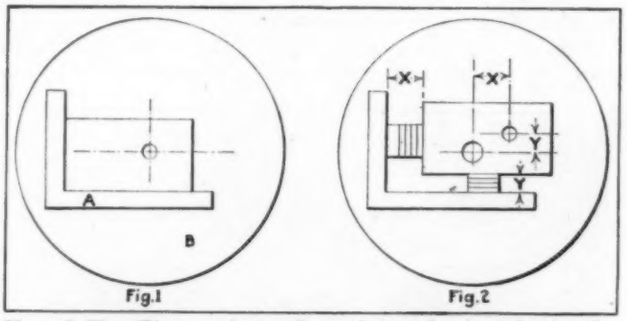
Accurate Location and Drilling of Holes—Discussion

By H. B. Schell

On page 706, Vol. 66, of the *American Machinist*, appeared a description of a method of locating holes in jigs by the movable button. As pointed out, this method is complicated and tedious. It is also expensive. A way we have used for years calls for no more machine tool equipment than a lathe, and gives very accurate results.

Two adjacent sides of the jig, if there are holes in one side only, are accurately squared. The jig is then clamped to the face plate as shown in Fig. 1, in a position to bore the hole furthest from the squared corner. A hardened and ground square, *A*, is then clamped to the face plate, *B*, in contact with the squared sides of the jig. The first hole is then drilled and bored to size.

The succeeding holes are located from the first by placing Johanssen blocks to the amount to give the proper location of the next hole, as shown at Fig. 2,



X and *Y*. The work is then clamped securely to the face plate, the gage blocks removed, and the next hole drilled and bored. The succeeding holes are done in the same way.

In a case where there are holes in more than one side of the jig, the additional side is squared before any boring is done, and then worked from the square. This method is rapid and accurate, and is not tedious.

Standard T-Slots for Machine Tools

One of the important problems of the production machine shop, where fixtures and other holding devices are in use, has been solved by the final adoption of American standards for T-slots in machine beds and tables. The standards as adopted by the American Engineering Standards Committee are the result of the joint work of the National Machine Tool Builders' Association, the Society of Automotive Engineers, the American Society of Mechanical Engineers, and the technical press. As a result of these standards all manufacturing fixtures with their attachments and bolts will interchange on the machines of all American machine tool builders.

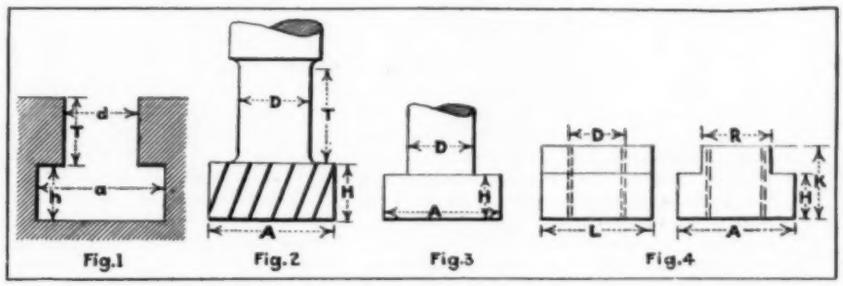


Fig.1 Fig.2 Fig.3 Fig.4

Agitation for the standardization of T-slots was begun as far back as 1889 by James W. See, the famous author of Chordal's letters. This agitation was revived in 1916 by Carl G. Barth, and again in 1922 by Fred H. Colvin and K. H. Condit, editors of the *American Machinist*. The National Machine Tool Builders' Association took up the subject in 1922, and the matter was taken up actively by the joint committee in 1924. The standards as now adopted will become effective at once for all new equipment. In Fig. 1 is shown the type of standard machine slot, and in Table I are given the dimensions for these slots. For some time there has been a demand for greater clearance in the slot to provide for oil and chip space, and to insure that the body of the bolt will slide freely in the slot. The committee therefore recommended a throat greater than the nominal diameter of the bolt, with the idea that this would eventually become the sole standard. For temporary use during the transition period, however there is provided an alternative standard having the throat width equal to the nominal diameter of the bolt.

Table I—Dimensions and Tolerances for Standard T-slots

Diameter of T-Bolt	Width of Throat d	Depth of Throat T		Head Space Dimensions and Tolerances					
				Width			Depth		
		Maximum	Minimum	Maximum (Basic)	Tolerance (Minus)	Minimum	Maximum (Basic)	Tolerance (Minus)	Minimum
¼	9/32	3/8	1/8	9/16	0.063	½	15/64	0.031	13/64
5/16	11/32	7/16	5/32	21/32	0.063	19/32	17/64	0.031	15/64
3/8	3/16	9/16	7/32	25/32	0.063	23/32	21/64	0.031	19/64
½	9/16	13/16	5/16	31/32	0.063	29/32	25/64	0.031	23/64
5/8	11/16	7/8	7/16	1 1/4	0.063	1 3/16	31/64	0.031	29/64
¾	13/16	1 1/16	9/16	1 15/32	0.094	1 3/8	5/8	0.031	1 9/32
1	1 1/16	1 1/4	¾	1 27/32	0.094	1 3/4	53/64	0.047	2 5/32
1 1/4	1 5/16	1 9/16	1	2 5/32	0.094	2 1/8	1 3/32	0.063	1 1/32
1 1/2	1 9/16	1 13/16	1 1/4	2 23/32	0.094	2 9/16	1 13/32	0.063	1 9/32

Table II—Dimensions for T-slot Cutters

Width of Throat Nominal Bolt Size		Thickness of Cutter H		Diameter of Cutters A		Diameter of Neck, D	Length of Neck, T
Standard		Maximum	Minimum (Worn)	Maximum	Minimum (Worn)		
9/32	¼	15/64	13/64	9/16	½	17/64	3/8
11/32	5/16	17/64	15/64	21/32	19/32	21/64	7/16
7/16	3/8	3 1/64	1 29/64	2 5/32	2 3/32	1 5/32	9/16
9/16	½	2 5/64	2 3/64	3 1/32	2 9/32	1 7/32	1 1/16
11/16	5/8	3 1/64	2 29/64	1 3/4	1 11/16	2 1/32	7/8
1 3/16	¾	3/8	1 9/32	1 15/32	1 3/8	2 5/32	1 5/16
1 5/16	1	3 5/64	2 5/32	1 27/32	1 3/4	1 1/32	1 1/4
1 7/16	1 1/4	1 5/32	1 1/32	2 7/32	2 1/8	1 9/32	1 9/16
1 9/16	1 1/2	1 11/32	1 9/32	2 23/32	2 9/16	1 17/32	1 13/16

Table III—Dimensions for Standard T-bolts

Diameter of T-bolt	Threads per Inch	Bolt Heads Dimensions and Tolerances						
		Width Across Flats, A				Height, H		
		Maximum (Basic)	Tolerance (Minus)	Minimum	Width Across Corners	Maximum (Basic)	Tolerance (Minus)	Minimum
¼	20	15/32	0.031	7/16	0.663	5/32	0.016	9/64
5/16	18	9/16	0.031	17/32	0.796	3/16	0.016	11/64
3/8	16	1 1/16	0.031	2 1/32	0.972	¼	0.016	15/64
½	13	7/8	0.031	27/32	1.238	5/16	0.016	19/64
5/8	11	1 1/16	0.031	1 3/32	1.591	13/32	0.016	25/64
¾	10	1 5/16	0.031	1 9/32	1.856	7/32	0.031	½
1	8	1 13/16	0.031	1 23/32	2.387	13/16	0.031	21/32
1 1/4	7	2 1/16	0.031	2 1/32	2.917	15/16	0.031	29/32
1 1/2	6	2 1/2	0.031	2 13/32	3.536	1 3/16	0.031	1 5/32

Table IV—Dimensions and Tolerances for Standard T-nuts

Tap for Stud D		Width of Throat T-slot	Width of Tongue R			Width of Nut A			Height of Nut H			Total Thickness Including Tongue, K	Length of Nut, L
Diameter	Threads per Inch		Maximum, Basic	Tolerance, Minus	Minimum	Maximum, Basic	Tolerance, Minus	Minimum	Maximum, Basic	Tolerance, Minus	Minimum		
¼	20	11/32	0.330	0.010	0.320	9/16	0.031	17/32	3/16	0.016	11/64	9/32	9/16
5/16	18	7/16	0.418	0.010	0.408	11/16	0.031	21/32	¼	0.016	15/64	5/16	11/16
3/8	16	9/16	0.543	0.010	0.533	7/8	0.031	27/32	5/16	0.016	19/64	17/32	7/8
½	13	11/16	0.668	0.010	0.658	1 1/8	0.031	1 3/32	13/32	0.016	25/64	5/8	1 1/8
5/8	11	13/16	0.783	0.010	0.773	1 5/16	0.031	1 9/32	17/32	0.031	1/2	23/32	1 5/16
¾	10	1 5/16	1.033	0.015	1.018	1 11/16	0.031	1 21/32	1 5/16	0.031	21/32	1	1 11/16
1	8	1 13/16	1.273	0.015	1.258	2 1/16	0.031	2 1/32	1 3/16	0.031	29/32	1 5/16	2 1/16
1 1/4	7	1 9/16	1.523	0.015	1.508	2 1/2	0.031	2 13/32	1 5/16	0.031	1 5/32	1 5/8	2 1/2

Continued on Sheet 13a

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Technical Abstracts

Wire Drawing

An investigation has been made to discover the nature of inclusions that cause wire to "run out" in drawing; that is, the resulting wire is slightly conical in that it may start out as No. 17 gage, for instance, but end up No. 16 gage, or larger, due to wear in the drawing plate. Examination of the polished surface of the wire indicated the presence of large quantities of minute specks of hard non-metallic material, which maintained its original form even after drawing of the wire.

The inclusions were crystalline in form and transparent. Hydrofluoric acid had no effect upon the crystals, isolated by dissolving the steel. Analysis showed them to be alumina. Steels that were made without the addition of aluminum as a deoxidizer showed no such crystals and generally drew without running out. In some cases, however, specks were present composed of manganese-iron silicates. These are more difficult to remove from the steel during manufacture than alumina crystals. — E. A. Atkins, *Engineering*, May 13.

Electrical Protection of Generators in Industrial Power Plants

Both d.-c. and a.-c. generators are used in industrial power houses. However, the prevailing practice is to use a.-c. generators for connection to prime movers, while d.-c. generators, incorporated in motor generator sets, together with rotary converters, are used for converting the d.-c. power required. Protection of a.-c. generating equipment resolves itself into the following items: protecting machines against overspeed; safeguarding generator bearings; and protecting the generator windings against over-voltage, excessive current, dirt and overheating. Protection against overspeed is obtained by emergency trips to supplement the governors controlling the prime movers. In steam plants the overspeed trip is installed primarily to protect the prime mover and, incidentally, provide protection for the generator. The overspeed devices are generally arranged to trip at 8 to 10 per cent overspeed. Frequent tests should be made on them to insure that they are in good working order.

Usually no further safeguard, other than thermometers placed on them, is provided for the generator bearings, the thermometer units being imbedded in the bearings and arranged to trip a relay usually when a temperature of 100 deg. C. is reached. Upon reaching this temperature this relay causes an alarm to be sounded.

The windings of a generator should be protected against several possible occurrences, namely, external faults, such as excessive current, either from sustained overloads or short-circuits external to the generator; internal faults, such as grounds, phase-to-phase short-circuits, short-circuited turns and open-circuits; excessive voltage generated in the windings; dirt deposited in the windings from the cooling air, thereby weakening the insulation; fire in the windings, and overheating.

It is necessary to provide over-voltage protection for the generators. Over-voltage may occur in a generator in the event it is disconnected from the busbars through the action of the protecting relays. Under such a condition, the generator would operate at no load with the excitation required for the load the generator had been carrying. As a result, the voltage would rise, possibly to an excessive volume. If only one generator were operating at the time it was disconnected by the relays, the voltage regulator would cause full field to be applied to the generator, for the regulator is governed by the busbar voltage and the latter would be zero in this event. To prevent this action, a circuit breaker is connected in the field circuit. This circuit breaker is tripped by a shunt trip, actuated from the contacts of the relays that trip out the oil switch in case of a generator fault.

Protection against overheating of the stator windings is best provided by measuring their actual temperatures. This procedure is accomplished by placing thermocouples or resistance-coil units between the upper and the lower coils in some of the stator slots at the time of manufacture. An instrument is connected to these units to give a record of the generator's temperature. —Arthur J. Whitcomb, *Power*, May 31.

A Test of Air Commerce

Forty pilots will take the air at Detroit on June 27 for a flight of 3,800 miles in 16 days' time to demonstrate to the American people that commercial flying is not a dream of tomorrow, but a fact of today. For the first time in a contest of this kind brakes will be used on the airplane wheels. This is considered important because when landing at a high-speed the distance within which a plane can stop is the most important factor, and the use of brakes will do much to eliminate the necessity for large landing fields, and will make it possible for a larger number of cities to consider commercial air terminals.

Statistics show that at the present time Germany leads the world in commercial aviation. Last year on 20 commercial lines in Germany planes covered 5,000,000 miles and carried 150,000 passengers. In the United States commercial flying has been largely limited to mail carrying. In the twelve months ending June 30, 1926, the air mail pilots flew 1,500,483 miles in day flying, and 955,654 miles at night. Yet in the United States there is at present only one regular passenger service which operates between Detroit and Grand Rapids, and which in the first nine months of service covered 56,000 miles and carried 1,254 passengers safely.

It is believed that at the conclusion of the coming air tour several important conclusions will have been reached as regards efficiency of airplane flights, and the practicability of establishing air routes. The greatest value, however, will probably come from the public interest that such a tour will arouse, and the demonstration of the fact that commercial aviation has reached a point where it must be given serious consideration in the transportation development of the United States.—*Finance and Industry*, June 4.

Select Small Tools Carefully

It is a difficult matter to judge the respective merits of different tools under shop conditions. If sample reamers, for instance, are sent to the shop and the foreman asked to keep his eye on them so that he can judge their merits, he generally gives them to a gang boss with the instructions he received. Unless the samples are very poor, the matter usually rests there until further inquiry is made. If some day the foreman is asked what he thinks of the reamers, he passes the question on to the gang boss who, being expected to say something, remarks that they are "not bad," or that they are "about the same as we are using," and so the matter drops. Without definite and well-planned tests it is almost impossible to tell which is the better of two reasonably good tools.

In the case of reamers, two kinds should be sent to the shop at the same time for comparative tests. Depths, feeds, time, power required, and all other factors should be carefully noted. The results of tests made in this way will often be surprising. Naturally, the best tool for one purpose may not be the best for another. For instance, the make of drill best suited for use on an automatic screw machine may not be so satisfactory for use in a drill press.—A. L. Walker, *Machinery*, May.

Application of X-Rays to the Study of Metals

The discovery made by Laue of the diffraction of X-rays by crystals has found numerous applications in industry. A crystal is characterized by the number and position of its planes. If a pencil of X-rays is caused to fall on a a crystal, a photographic plate perpendicular to the initial direction of the rays will show a spot analagous to that produced by a luminous pencil on the crystal, due to the reflection of the rays.

When the bundle of X-rays is parallel to one of the axes of the crystal a symmetrical image is obtained. A deformation of any kind, due for instance to cold working of the metal, or a flaw, reveals itself by a new disposition of the points of interference and symmetry no longer exists. For the study of a substance in the form of a disordered mass of small crystals, recourse is had to monochromatic X-rays. In this case only one part of the crystals will reflect the particular wave length used. This is the Debye-Scherrer method.

X-rays are particularly valuable for the study of alloys. The relative position and intensity of the lines permit of determinining the number of types of crystals in the substance studied and its internal structure.

The examination of metals by X-rays allows taking the effects of tempering into consideration. The monochromatic radiograph of a metal shows a certain number of circles consisting of points of variable size. After tempering, it is no longer possible to distinguish points, and circles of interference are generally divided into many fragments. Annealing manifests itself by a reappearance of the points.

The employment of X-rays permits the easy inspection of parts from which samples cannot be taken, the plates of of a boiler for example. Radiometallography furthermore is of great interest in foundry work and in the electrolysis of metals, since it provides an easy control of the structure of ingots and electrolytic plates. It constitutes a valuable auxiliary to chemical analysis. Welds in finished pieces may also be examined. The inspection of substances of great density and high atomic weights presents some difficulty, but flaws 1mm. in length will be revealed through a thickness of 10 cm. of steel or 6 cm. of brass.

The necessary installation comprises high-tension apparatus, tubes, and photographic apparatus. The transformer, tubes and work table may be mounted in separate places or the whole apparatus, with the exception of the tubes, may be mounted on a moveable table. The tubes may be mounted in a fixed place or made movable by themselves. It is to be hoped that this apparatus can be simplified, so that small laboratories will be able to apply these methods.—*Le Genie Civil* (France), May 28.

The German Cruiser "Königsberg"

The cruiser "Königsberg," launched at Wilhelmshaven March 26, is of novel design. Her displacement conforms to the Peace Treaty limit of 6,000 tons, and she is therefore of the same size as the "Emden," the first German postwar cruiser. But here the resemblance ends, for the "Königsberg" is the superior in speed and gun power. Her length on the water line is 169 m., her beam is 15.2 m. and her draft is 5.3 m. The main propelling machinery consists of two main and two cruising turbines with gearing operating twin shafts, and taking steam from six double-ended, oil-fired boilers. The designed horsepower is 65,000 and a speed of 32 knots is expected. A Diesel unit is installed for cruising purposes, making her the second large surface war ship to be propelled by internal combustion engines, though, as in the case of H. M. S. "Adventure," they are used for cruising speeds only. The "Königsberg" will have an endurance of 5,500 miles at an economical speed of 14½ knots.

She is to have nine 5.9-in. guns mounted in triple turrets. While she can fire a broadside from nine guns, three guns can be fired ahead and two astern. The mounting of guns of this caliber in triple turrets is an innovation. Four 3.4-in. A-A. guns and four torpedo tubes are also to be carried.

The hull is of the highest grade of steel, and electric welding has been extensively employed in its construction. Two other cruisers, presumably of the same class, are to be launched shortly. — *The Engineer* (England), May 20.

Metal Propeller Development

Although the tests of the U. S. Army Air Corps deal with propellers having detachable blades, acknowledgement is made of the value of the Reed type of metal propeller now largely used in commercial service. The detachable blade as now used has advantages over the fixed-blade type as follows:

1. To allow changing the angularity of the blades and likewise the adjustment of pitch.
2. To provide interchangeability, suitable for two, three or four-blade propellers.
3. Flexibility of design is better accomplished with detachable blades.
4. Adaptability of a detachable-blade propeller to fit different designs of planes is greater than that of a one-piece propeller.
5. Manufacturing cost per blade is less.
6. Operating costs are less, since a single blade can be replaced instead of a whole propeller.
7. Stock requirements may be kept up with a smaller number of blades, at reduced cost and in less storage space.
8. Standardization and production methods can be better materialized with a single detachable blade.

The use of aluminum alloy for propellers has largely eliminated wood.—E. G. McCauley, U. S. Army Air Corps, *Aviation*, May 30.

How Useful Are High Speeds?

The issues arises as to whether high engine speeds can be usefully employed in the automobile of everyday use. It may be worth while mentioning that the horsepower developed by an engine depends upon the average pressure exerted on the pistons and the distance the pistons move per minute under the influence of this mean pressure.

The mean pressure on the pistons in pounds, multiplied by the radius of the crank in inches, divided by 1.57 is the torque of the engine in pound-inches. Horsepower, therefore, is proportional to torque multiplied by revolutions per min. Thus a torque of 2,000 pound-inches will produce 47.6 hp. at 1,500 r.p.m., or 1.500 pound-inches torque will produce 47.6 hp. at 2,000 r.p.m., or 1,000 pound-inches 47.6 hp. at 3,000 r.p.m.

If for a moment it be granted that engine peaking at say 6,000 r.p.m. are just as reliable, economical, and as cheap to make as existing types, it is obvious that the reduced sizes of clutch and transmission allowable through the reduced torque constitute very important potentialities in respect of reduced cost of production. Regarded from the historical viewpoint, there has been a steady increase of engine speed during the past 20 years in which the U. S. has, contrary to general opinion, led the way.

The United States developed the "all on high" type of car, necessitating a low rear axle gear ratio, and therefore for the same road speed (which is not so different in the United States and Eurpoe), an engine which gave about 50 per cent more revolutions per mile always, and per minute at its maximum speed. European practice has in general, followed the United States in this respect but not nearly to the same extent, since the "all on high" type of car pays heavily for this advantage in high fuel consumption.

It is the low load factor in an automobile engine which dominates the situation in respect to design and is responsible for the empirical nature of so many constructional details. It is seldom realized that at 30 mp.h., about 6 hp. is required from a power unit capable of producing 60 hp.—Laurence H. Pomeroy, *Automotive Industries*, June 4.

Does Business Need a New Bag of Tricks?

Engineering and scientific progress are combining with changing public opinion to upset traditional methods of doing business. The new competition which is upon us, or barely ahead of us, is not nearly so simple as the old competition which consisted mainly of price cutting. Competition is not limited to single lines or products. Radio competes with vacuum cleaners, automobiles with oriental rugs, kitchen cabinets with electric refrigerators, Listerine with cloves and tar soap.

Competition is for the consumer's time as well as for his money. He can't use up an automobile, tires and gasoline if he sits on the porch listening to his radio. He can't read magazines while he is at the movies. There is also competition between methods of distribution. Chain stores, direct selling and powerful buying organizations all affect business methods.

To keep up with the times every business must study its product and its methods to determine whether a "new bag of tricks" is needed. Generally speaking, the public is tired of old favorites and demands new and better ones synchronized with the increased speed of life since the war. 1914 seems to be the dividing line. Therefore, every product, every policy, every process that was in use in 1914 should be challenged to see if it is in line with the best that is in vogue today. Are there new markets for present products or new products that can be made by the present plant and organization? It is vital to know.—R. R. Updegraff, *The Magazine of Business*, June.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

A New Basis for Overhead

TRADITION dies hard—and largely because it takes no account of changed conditions. Perhaps the most insidious and therefore the most dangerous tradition in management is that "overhead" is always an evil—and to be avoided.

Few realize the extent to which this tradition grips the minds of otherwise intelligent managers and directors. Nor how far this tradition that overhead is always bad interferes with progress and works injustice to individuals.

While all managers know that improved machinery makes for lower production costs, any increase in overhead, based on direct labor, throws them into a panic. Percentages hound them like a stalking ghost.

Perhaps the easiest way to overcome this state of mind is to change the basis on which we figure overhead. Direct labor may have been a good basis in the day when the hand and individual skill was necessary in all work. For it frequently happened that direct labor was the largest single item of cost. But that condition passed with the coming of high-production machinery. Today direct labor is one of the smallest items in practically all mass production.

What we are really most interested in is the total cost of the product. It is suggested that this be made the basis of overhead rather than direct labor. Then the percentages will drop materially and many managers may be saved from violent attacks of heart failure. For it frequently happens that machine overhead and indirect labor are the most profitable factors in the business.

Over 700 Employee Magazines

THE existence of over 700 magazines published by employers for their employees indicates a wide-spread belief in the value of this method of communication. For in reality, the employee magazine is usually a means of keeping employees of a large organization informed about its various activities. As with all other company policies, however, the effectiveness of these publications depends very largely on the attitude of the men at the top. Unless the higher executives appreciate the opportunity afforded by such publications to make the company policies clear to the employees, and take advantage of these opportunities to cultivate and maintain good will, such magazines are an unwarranted expense.

Employee magazines can do much to make the workers understand and appreciate many of the problems of management. Facts concerning these problems, and facts only, must be presented and in a convincing manner. Employees are quick to know when management is trying to put something over on them—and suspicions are then aroused concerning any statements made. Preachments of any kind are of little value. But the editor who can use some outstanding incident that the men know to be a fact to drive home a point—is a great factor in maintaining harmony.

Conserve Coal

THAT the non-union soft coal mines are able to produce the coal needed for the summer requirements of industry seems to have lulled some managers into a false feeling of security that manifests itself in draughts from their reserve stocks. The situation in the coal industry is not alarming but it may very well become so if enough industrial organizations exhaust their reserves at the same time and start bidding against each other in a tight market. Common prudence would indicate the wisdom of maintaining reserves and purchasing spot coal for current requirements.

Foreign Representatives

MANY industrialists are looking longingly at foreign markets for their excess capacity and some of them are beginning to realize what is the greatest difficulty that must be overcome before success rewards their efforts. Banking facilities abroad, while not all they should be as yet, are vastly better than they were only a few years ago. The Bureau of Foreign and Domestic Commerce, with headquarters at Washington and representatives all over the globe, is rendering a masterly information service. But where are the men who are willing to leave the United States and spend years in foreign countries as representatives of American firms?

Opportunities at home, surrounded by relatives and congenial friends, have been far too numerous for the average young man to feel greatly called upon to live abroad. But if we are to have any foreign trade worthy of the name we must awaken the interest of business men in parts of the country other than the narrow Atlantic and Pacific coast fringes. Some way must be found to paint its glamor to the young and ambitious men who ache to get the world by the tail. England has done a wonderful job along these lines and her methods could well be studied by Americans.

Shop Equipment News

Bradford Special Manufacturing Lathe

THE special manufacturing lathe shown in the accompanying illustration has been arranged for turning and facing bell-housing cases for an automotive manufacturer. The machine was built by the Bradford Machine Tool Co., Eighth and Evans Sts., Cincinnati, Ohio. It is semi-automatic in operation, and with a few changes in tooling and fixtures, can lend itself to a wide variety of work.

The bell housing is held in a special fixture on the nose of the spindle. The work driver mechanism comprises two rods hinged at one end to a sliding shoe in the faceplate. On the opposite ends of the rods driving pins are provided, which are loosely guided in slots in the faceplate. With this arrangement, the driving pin at the end of the heavier link pushes against one lug on the bell housing, while a second driving pin at the end of the lighter link pulls against another lug on the bell housing. The single sliding shoe at the two hinged ends of the links serves to equalize the push and pull strains against the lugs on the bell housing, thus resulting in a balanced drive for the work.

The machine cycle is as follows: The tool carriage is hand traversed by means of a rack and pinion to the left until it comes up against a fixed adjustable stop, at which point it is securely fixed to the bed by means of a powerful eccentric clamping device. The control lever is then actuated, causing both the rear and front set of cutting tools to be advanced toward the work by means of a power-driven, cross-feed screw. When all the tools have come to the end of their respective cuts, an automatic power feed cutout functions. In this way the operator is permitted to slightly hand feed the tools to a positive diameter stop in order to maintain accuracy and size duplication on all the bell housings.

After the carriage clamping device is released, the control lever is shifted to its automatic quick-return position. Simultaneous quick recession of both the front and rear cutting tools, as well as quick return of the tool carriage itself back to its inoperative position, takes place.

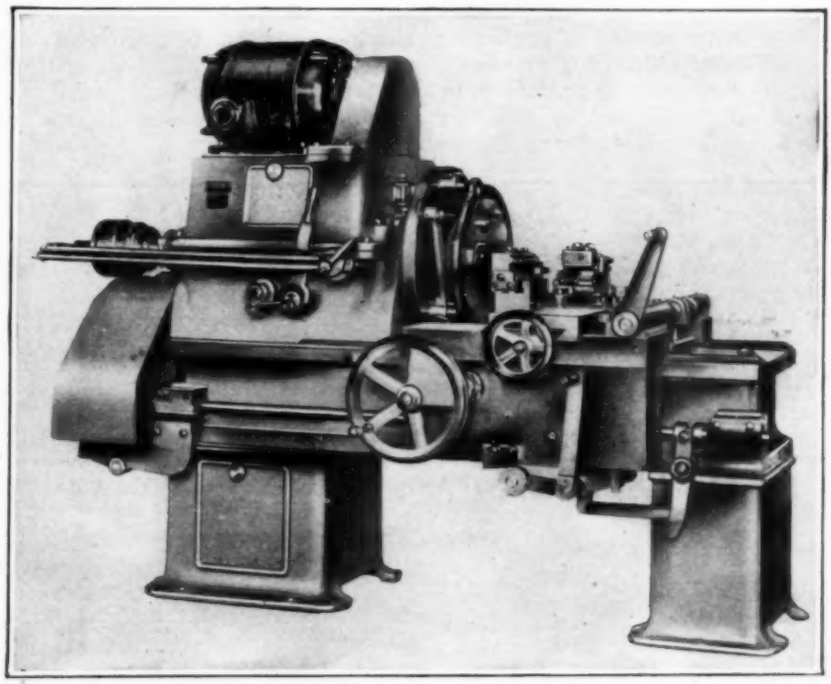


Fig. 1—Bradford Special Manufacturing Lathe for Finishing Bell Housings

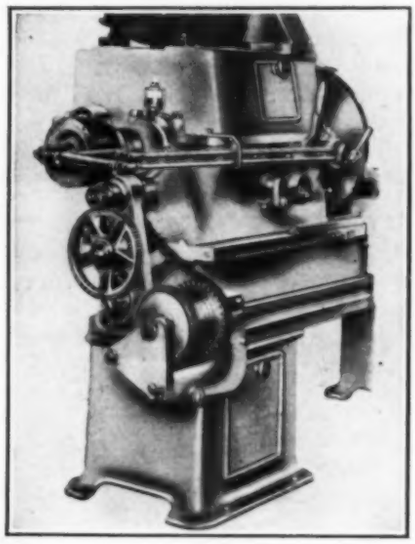


Fig. 2—Air clamp and feed mechanism

The finished bell housings may then be conveniently removed and an unfinished piece put in its place.

Clamping of the piece on the faceplate is accomplished mechanically by means of an air cylinder shown on the end of the spindle in Fig. 2. The lever shown in the front of the head in its left-hand position applies the power to the spindle, and in its right-hand position quickly stops the spindle through the application of a powerful spindle brake. The feed gears and rapid return chain drive can also be seen in this view.

Hisey-Wolf ⅞-Inch Universal Electric Drill

The standard-duty ⅞-in. universal electric drill shown was recently placed on the market by the Hisey-Wolf Machine Co., Cincinnati, Ohio. It is equipped with a standard motor of this company's own design and manufacture, which is said to be particularly suited for this class of service.

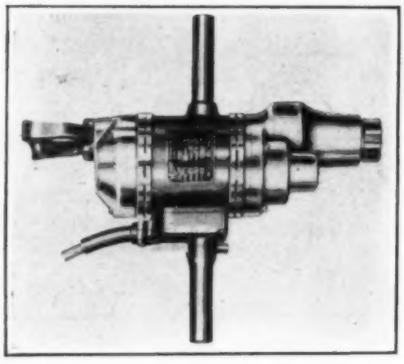
The motor is mounted on ball bearings which are fitted in such a way as to eliminate slip and creeping action, said to be detrimental to the motor and other mechanical parts. The gear of the armature shaft is removable. All gears are made of high-grade steel, electrically heat-treated, and so proportioned as to

Shop Equipment News

give maximum strength and smooth operation. The compound gear shaft is supported with bearings at each end.

The drill spindle is of liberal dimensions, hardened and ground, and is automatically lubricated through the gear case. It is fitted with a No. 3 Morse taper socket.

In order to provide brush adjustment when necessary, the brush holders with adjustable spring tension are mounted as a separate unit on a bakelite yoke. The brushes are accessible by removal of the end handle cover, which is a rugged casting carrying all pressure applied on the drill independent of the motor and motor bearings. The Hisey patented switch is standard equipment.



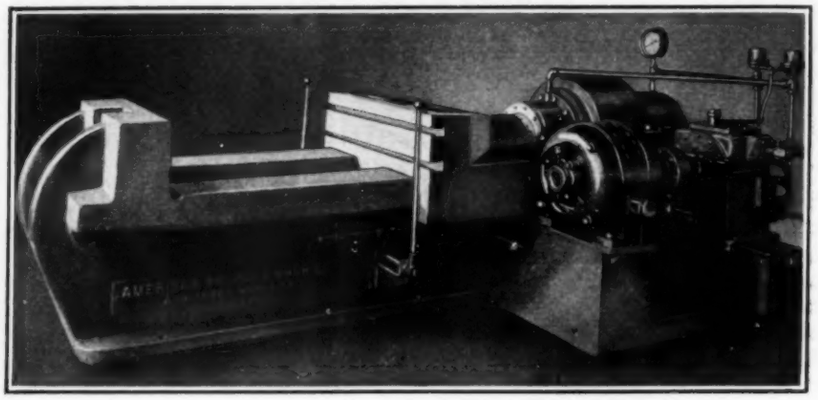
Hisey-Wolf ¾-Inch Universal Electric Drill

The drill weighs 25 pounds.

American Broach & Machine Co. 100-Ton Bulldozer

The 100-ton hydraulic horizontal press, otherwise known as a Bulldozer, shown in the accompanying illustration was recently placed on the market by the American Broach & Machine Co., Ann Arbor, Mich. The machine is driven by an oil pump, size F W, producing a maximum pressure of 1,000 lb. per sq.in. The pump is driven by 7½-hp. motor, operated at 900 r.p.m. The normal operating speed of the pressure stroke is 18 in. per min. and of the return stroke, 36 in. per minute.

The jaws are 36 in. wide and 11½ in. high. The stroke of the sliding jaw is 18 in. and the face 44x11¾ in. The minimum distance between opening of jaws is 32 in., and the maximum 50 in. The jaws are fitted with two T-slots for fastening various fixtures. The ways have an overall width of 36 in. with a sliding bearing surface 11 in. wide on each side. The ways are 25 in. from the floor. The machine is fitted with knock-off stops for setting to a predetermined length of stroke, as well as for preventing the over-run of the ram. It requires a floor space of approximately 14x9 ft., and weighs complete with motor about 20,000 pounds.

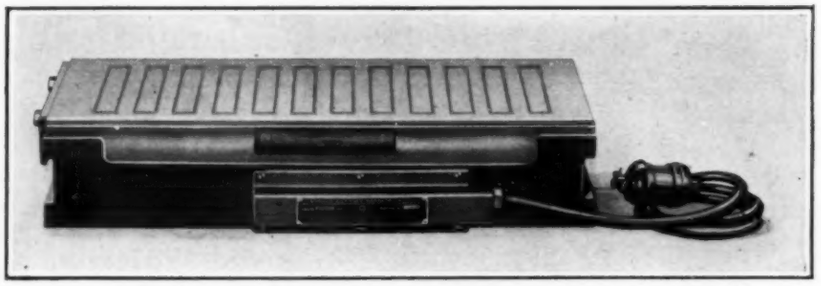


American Broach & Machine Co. 100-Ton Bulldozer

Taft-Peirce "Superpower" Magnetic Chuck

AN IMPROVED series of "Superpower" magnetic chucks has been developed by the Taft-Peirce Manufacturing Co., Woonsocket, R. I. Size No. 618 is shown in the accompanying illustration.

The Superpower chuck comprises a base portion or body integral with which is cast a number of projecting cores, inclosed collectively by a wall. Each of these cores is adapted to be magnetically energized by a coil of wire which is connected with similar coils in such a manner as to be electrically energized by direct current conducted to the interior of the chuck by a flexible cord from a terminal box. This terminal box is secured to the chuck body so that leads may be taken to it from either the left- or the right-hand side of the chuck. Between the terminal box and the chuck body is a water-tight gasket, which prevents water or grinding fluid from reaching the interior of the chuck.



Taft-Peirce Size No. 618 "Superpower" Magnetic Chuck

SPECIFICATIONS

Size No.	618	722	1,134
Style of plate	Plain	T-slot	T-slot
Working surface, in.	6x18	7¾x22	11x34
Magnetic surface, in.	5 11/16 x16½	6⅞x20½	9½x32
Size of base, in.	6½x18	6½x22	10x33⅞
Height, in.	3⅝	3 13/16	4¼
Net weight, lb.	105	128	360
Power consumed, watts	121	185	550

Shop Equipment News

The faceplate or magnetic working surface fastened to the top of the body comprises a magnetizable frame transversed by a series of closely spaced bars of magnetizable material. Each bar has a surface forming a pole face in the work face of the chuck. Mechanically united with this frame, but magnetically separated therefrom is a series of bifurcated pole members. Each of these pole members has a flat base portion adapted to co-operate with a chuck core, and a pair of upstanding poles interspaced with the bars transversing the frame. Hence the faceplate comprises a shell inclosing a series of magnetically energized cores. The frame of the faceplate registers with the walls of the chuck body and the base from each pole member registers with one of the cores. These cores, as stated above, are energized by individual coils.

The method of construction results in a strong and rugged chuck affording a large magnetic area with a minimum of height. Particular pains were taken to make the unit waterproof, even if leakage should occur at the gasket or at the face plate.

The coils were specifically developed for this class of service. They are said to be able to withstand the large voltages induced during the reversal of current at demagnetization and to permit operation over a wide range of normal voltage, to take care of variation in plant voltage. Thus a unit rated for 110 volts can safely be operated up to a voltage of 125, while those rated for 220 volts can operate safely up to 250 volts. The insulating materials were chosen for their high-dielectric properties and are distributed in such a manner that every vital point in the entire chuck is protected by double the ordinary thickness, it is claimed. In addition every coil is thoroughly impregnated with high-grade insulating varnish, which is then baked on. Each coil is treated twice in this manner.

An improved type of demagnetizing switch has been developed for this series of chucks and is furnished as standard equipment with the smaller size.

It is said that a number of new setups can now be readily handled. The increased density and concentration of the magnetic flux, as well as its distribution with respect to the working surfaces, enables small pieces of work to be held securely to a thin sheet of steel placed on top of the standard faceplate. By this method the work may be distributed without regard to the pole pieces or the polarity of the chuck cores. Work can also be held on parallels or angle blocks by means of the leakage of magnetic flux through these pieces.

The Superpower magnetic chuck is for use only with direct current and can be supplied for either 110 or 220 volts.

Rotor Air Sander

THE air sander shown in the accompanying illustrations is an additional unit in the line of air-driven portable tools made by the Rotor Air Tool Co., Cleveland, Ohio. This line was recently purchased from the pneumatic tool division of the Warner & Swasey Co., of Cleveland. The sander is designed to provide ample power for metal finishing operations, such as grinding, sanding or wire brushing.

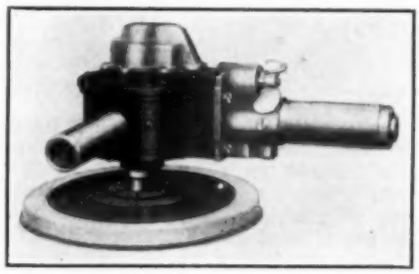


Fig. 1—Rotor Air Sander with Sanding Disks

The motor is mounted directly over the pad or wheel and drives without the use of gears. The unit weighs only 11 lb., is said to be well balanced and free from vibration. When used with the sanding disk shown in Fig. 1, it is intended for finishing automobile bodies, metal furniture, and the like, and for finish grinding of semi-steel die blocks and machine castings. When equipped with the cup wheel shown in Fig. 2, the machine is well adapted to rough grinding electric welds on automobile bodies and other fabricated steel units. The machine is also suitable for use with wire cup brushes for cleaning rust from metal surfaces.

The principle of operation of the rotor motor is shown in Fig. 3, which gives cross-sectional views of one of the two cylinders. In each cylinder an eccentric rotor revolves inside the inner wall of the cylinder. The air enters the motor through the air inlet as shown, and passes directly into the cylinder as indicated by the heavy black portions. The rotor is driven in a clockwise direction. A part of the air also exerts a constant downward pressure on the rotor blade, thus sealing all direct connections between the inlet and exhaust ports.

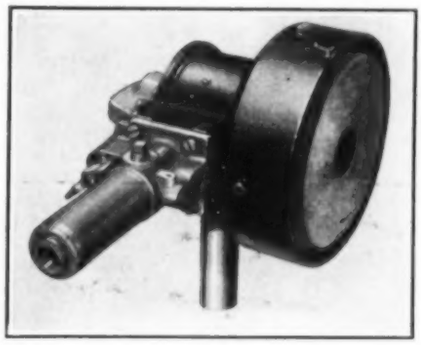


Fig. 2—Sander with cup wheel and adjustable wheel guard

The rotors are keyed to the shaft

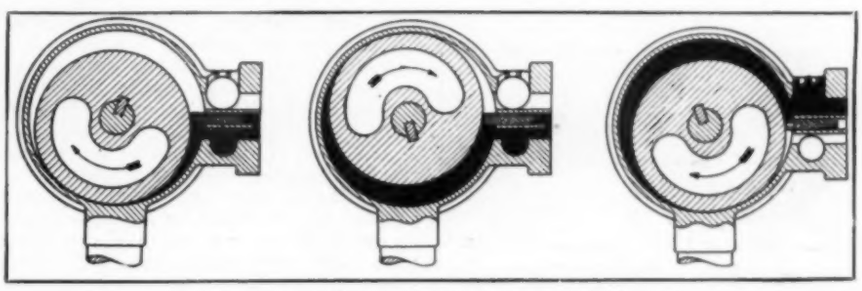


Fig. 3—Operating principle of the Air Sander

Shop Equipment News

in opposed positions. When the rotor in one cylinder is in position for exhaust, that in the other is at the midpoint of its upward power impulse. It is claimed that this construction gives perfect motor balance and produces an even flow of power that is free from vibration. The speed may be changed by an adjustable governor from 4,500 to 6,500 r.p.m. With this range of speeds, the machine is suitable for use with pads of either 9 or 7 in. in diameter.

Maintenance costs are said to be low, since there are only three moving parts. The shaft runs in ball bearings. A governor automatically reduces the speed when the pad or cup wheel is removed from the work. Oil is supplied through a reservoir in the handle, and its flow can be regulated by a needle valve.

Black & Decker Portable Electric Grinder

The Black & Decker Manufacturing Co., Towson, Md., has brought out two sizes of portable electric grinders employing an improved form of internal gear drive. The outside appearance of one of the grinders is indicated in Fig. 1, while

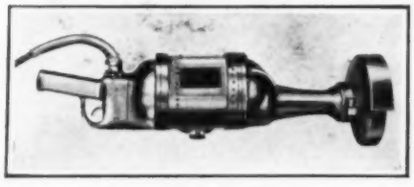


Fig. 1—Black & Decker Portable Electric Grinder

in Fig. 2, the internal drive is shown. With this construction the diameter of the gear housing is reduced because of the placement of the gear centers.

It is said that this internal gear is of sturdy construction, resulting in great strength and long wear, and that it is less subject to distortion from heat-treating. Smooth operation is also claimed. The wheel spindle is supported at each end by tapered roller bearings to take both radial and thrust loads from the wheel. The ventilation holes of the motor have been so placed as to protect the windings from sharp particles of grit that may be drawn into the motor with the ventilating air.

The motor used is of the universal type.

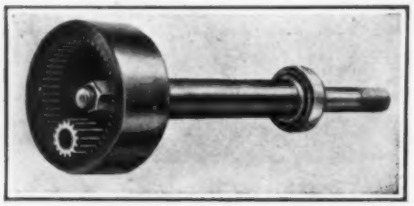


Fig. 2—Internal gear drive of the grinder

Trade Catalogs

Air Compressors. The national Brake & Electric Co., Milwaukee, Wis., recently published its Catalog No. 807 on sleeve-valve type air compressors. The publication contains twenty-four 8½x11-in. pages, and is well illustrated throughout by photographs. A description of the constructional features of this type of compressor is given, as well as complete specifications for each size.

Drills, Electric. The Goodell-Pratt Co., Greenfield, Mass., has put out its first catalog on electric drills. The chief constructional features of this type of equipment are explained with the aid of photographs. For each size of drill there is a photograph of the unit, a performance chart, a tabulated description and complete specifications. In addition to electric drills, drill stands and polishing and grinding heads are illustrated and described. The bulletin is pleasingly arranged.

Elevators, Bucket. The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., has issued Book No. 680 entitled "Link-Belt Typical Elevators." In it, complete information is given on bucket elevators for handling material in bulk. The units are illustrated by photographs and line drawings, and complete specifications are given in each case. Several typical applications are also illustrated.

Lathes. The Greaves-Klusman Tool Co., Cincinnati, Ohio, has issued a leaflet describing in brief its G-K Lathe with single-lever control. The chief features of the machine are pointed out. The leaflet is illustrated.

Milling Machine Standard Arbors. The Cincinnati Milling Machine Co., Cincinnati, Ohio, has published a booklet entitled "Putting Quality Plus Into Cincinnati Standard Arbors." It contains twenty-four 8½x11-in. pages, and is profusely illustrated throughout by means of photographs. The advantages of the standardized spindle end are first pointed out, followed by a complete description of its manufacture. A complete list with specifications is then given for the various forms of standard arbors and standard arbor ends. The line of milling machines made by this company is also illustrated.

Motors, Electric. The Wagner Electric Corporation, St. Louis, Mo., has published two bulletins on its electric motors. Bulletin No. 149 is devoted to the "66" motor, single-phase, fractional-horsepower type, while Bulletin No. 150 is devoted to the "76" motor, a repulsion-induction type of slightly higher horsepower. Both bulletins are perforated for insertion in loose leaf folders, and in each the chief constructional features are pointed out. The bulletins are illustrated.

Pneumatic Tools, Portable. The Rotor Air Tool Co., Cleveland, Ohio, has published an illustrated catalog on its portable pneumatic tools. Grinders, drills and sanders are shown. The principle of operation of the air motor driving these tools is first explained with the aid of cross-sectional views. Each type of unit is explained and illustrated. The publication contains 16 pages.

"Selsyns." The General Electric Co., Schenectady, N. Y., has issued bulletin GEA-722 on the so-called Selsyns for distant signaling, control and indication. These units are essentially synchronous interconnected motor-generator sets. The construction and operation of the device are explained and the chief features pointed out.

Speed Reducers, Worm-Gear. The Fawcus Machine Co., Pittsburgh, Pa., has issued Bulletin "E" on its worm gears and drives. The publication contains thirty-two 8x10½-in. pages, well illustrated throughout. The general constructional features are first pointed out, and a brief description of the manufacture of the units is given, aided with photographs. Lubrication is explained, and some typical applications are shown. A large part of the book is devoted to engineering data showing dimensions and horsepower ratings. A complete list of hobs for worms is also given.

Speed Reducer, Internal-Gear. The D. O. James Manufacturing Co., 1114 W. Monroe St., Chicago, Ill., has issued an illustrated leaflet pointing out some of the principal features of its internal spur gear speed reducer. Several typical applications are also shown.

Starting Panels. The General Electric Co., Schenectady, N. Y. describes in its bulletin GEA-763 isolated-type induction motor starting panels. The publication contains 16 pages and is perforated for insertion in a loose-leaf folder. Complete technical descriptions of the construction of the apparatus and considerable engineering data are included. The bulletin is illustrated.

Welders, Spot. The Acme Electric Welder Co., 5617 Pacific Blvd., Los Angeles, Calif., has available for distribution several circulars describing its spot welding outfits. The circulars are illustrated.

NEWS OF THE WEEK

Italy's Immediate Future Rests Upon Adjustment to the Rising Lira

Wages and cost of living are being slowly reduced

By Edward J. Mehren
Vice-President, McGraw-Hill Publishing Company, Inc.

SO MUCH has been written lately about Italy and Italian conditions that one is in danger of repeating what is already well known in the United States. In this article the emphasis will be laid on the economic and industrial situations, but even in an economic discussion the political and social conditions cannot be excluded. The social situation, in particular, forces itself on the attention of the visitor. It is the outward spirit of the new Italy; it permeates the atmosphere and colors every contact that one has on the streets, in offices, in railway trains. Italy socially is a new land. Its people are conscious of the change and show their pride. Underneath there may be—there undoubtedly is—grave reservation as to the need or wisdom of the methods that have been employed; but, for the obtaining of results, "the plan works," and to the hurried traveler all looks placid.

Economic Situation

As to economic conditions, it is clearly evident that prosperity reigns. The people on the whole are well-dressed and have a confident bearing. The latter point is important; judged by the economic experience of other countries, Italy should now be under severe economic distress. A year and a half ago the lira stood at 30 to the dollar. Now it is 18½. It has gone from, say 3½ cents to 5½. The usual accompaniment of such a rise is the falling off in buying power and a decline in exports, resulting in a decrease in demand on industry, unemployment and the usual accompanying distress.

These phenomena are not absent here now, but, as yet, there is not a crisis. There has been export decline, but it is slight. There is unemployment, but not serious, though a goodly number of factories are on a part time basis. Possibly the best general index is that of electric-power sales. While the annual increase in sales since the beginning of prosperity under the Mussolini régime has been at the rate of 10 per cent, the increase in the first four months of this year over the corresponding period of last year has been about 3½ per cent. The rise in the lira, then, has slowed down development but has not precipitated a crisis.

Naturally, the big question is as to the future of the lira. Some feel that it has improved too rapidly; they would, in fact, like to see it slip back so that export and tourist trade would be encouraged. Evidently Mussolini is fully aware of the situation, and the future campaign will be determined by the results of this one; and the results are not yet fully apparent. What the future holds economically even with the lira held at its present position is not clear. Some predict a more serious situation, maintaining that the full effect of the increased valuation is only now beginning to be felt; until now goods have been shipped on contracts made before the rise. New orders, on the new value of the lira, are not coming in in so large a volume.

On the other hand, there are men of affairs who believe that the present political régime will adopt measures—and successfully enforce them—that will prevent serious distress.

The crux of any situation like this is that prices are not reduced in proportion to the increase in value of the exchange medium. The fascist régime is now tackling this point. As of June 1 the salaries and wages of all in national government service will be reduced 10 per cent; this includes the wages of post office and railway employees. Through the Union of Confederations of Industry, the industries will be requested to make a similar reduction.

But wage reductions alone would virtually increase the cost of living, by reducing the purchasing power of the worker. Therefore, there has been decreed compulsory decreases in rent and in food necessities. Rent, now from five to seven times pre-war prices, must be reduced to four times the pre-war basis. Milk, bread, rice, macaroni and meat have been reduced 10 per cent. The enforcement is very severe, and precautions are taken that the law is not evaded by decreasing quality. Going still farther, the communes are co-operating and have requested all merchants to make general reductiors in prices. The shop windows in the cities and towns are almost all displaying reduction signs ranging up to 30 per cent.

The hotels have put into effect a 10 per cent reduction and hope, they say, to make further reductions. Here necessity has been an added spur; the tourist travel had fallen off.

Obviously, the 10 per cent decrease is out of all proportion to the increase in the value of the lira; even the sharp recent increase has been 40 per cent. A beginning, however, has been made, and those who believe that a sharp crisis will be avoided look forward to a repetition of the recent price and wage reductions.

Incidentally, these wage reductions may well be a test of the strength of the Mussolini régime. It is easier to hold the multitude on a rising market than to lead them backward. True, price reductions may hold the purchasing power even, but cash in hand means more to the un-lettered than purchasing power. Nevertheless, the fulsome advertising in the press, by commune proclamations, by displays in shop windows, by general conversation constitutes a mass campaign of education that may impress everyone.

But no matter what the immediate situation, Italy has a difficult economic position. She lacks natural resources, her soil cannot now support her people, she lacks the capital resources to industrialize rapidly enough to give employment to a rapidly increasing population. Before the war her surplus population emigrated, principally to the United States; she has not yet created the mental conditions to avail herself of other outlets—South America, and possibly Canada. She came out of the war with a high per capita debt charge that necessarily will go on for more than a generation.

Yet she has a population of marked intelligence, capable, if there were opportunity, of playing a great industrial rôle. She must industrialize—that is the law of the present day world; but on that industrialization is placed the handicaps referred to.

General Conditions

Just now, her trade balance is adverse, yet she has large payments to make on war debts. Nevertheless, she is borrowing abroad money that will require a still greater excess of exports in order to pay the interest and, when the time comes, the principal. American bankers alone have loaned Italy, the government, Rome, Milan and industries about $277,000,000 in less than two years.

The task involved is no small one. Italy's "way out" is to cut down her standard of living, to reclaim her swamp and arid lands and to develop her hydro-electric power. Thus she will cut down her imports of foodstuffs, and coal. To increase her export side, she plans further industrialization, and is building a great merchant marine which will build up her "invisible exports." Though the task is large, the outlook is not impossible judged by Italy's pre-war financial position. The Italian, with the new-born confidence, feels sure of the future, even though he realizes and admits that the task is big.

Employment Increases in England But Not in Mechanical Lines

Machine tool imports 50 per cent higher than exports

BY OUR LONDON CORRESPONDENT

OFFICIAL figures suggest that during the past few weeks a considerable improvement in industrial occupation has set in, and the number of unemployed in Great Britain is now considerably lower than one million, the lowest number in some six years or so. The figures have fluctuated a little, and no doubt much of the improvement arises from seasonal causes; but it is an improvement, for which we are truly thankful. Then again, the cost-of-living figure has shown some decline, being 64 per cent above the immediate pre-war period, or the lowest for ten years or so.

MECHANICAL LINES POOR

Unfortunately, the heavier industries cannot on the whole be included among those that have taken on more workpeople. In the coal trade, the output markedly exceeds the demand, and the cut in prices for domestic supplies instituted by the middlemen has not yet had time to show real effect. Generally heavy reductions have been effected in prices, while wages are in many instances at the minimum permitted by last year's agreement: yet, apart from the unemployed, many men are working practically half time. The iron and steel industries, despite cheaper coke, are little better off than they were, and the position of engineering as a whole hardly suggests improvement. Thus, in railway carriage and wagon works, while reports suggest that the larger companies have a fair number of orders on hand, new orders are not being received at the same rate these are being completed. For the present, not much is expected from the railway companies, on account of their financial position. Still, despite overseas competition, orders have been received of late from South Africa and a number of the British dependencies are also placing orders, while Central and South America have also helped.

The motor car industry on the whole is in a satisfactory position, but conditions vary markedly, and American competition is felt, despite the protective duties. Still, for this branch of engineering there is but little present anxiety, and the export business of both pleasure and commercial vehicles, particularly in connection with the British dominions overseas, is at least steady and, in fact, appears to be growing. The motorcycle industry is providing an amount of work, though one or two reports suggest that the demand has not quite met expectations The firms concerned in the production of bicycles report on the whole satisfactorily, but export is not at present up to last year's figures.

The machine tool industry, in the most favorable view, cannot be regarded as having improved of late: indeed, in several quarters it is causing much anxiety. Domestic demand is slow and, although one or two firms have suggested an improving export position, yet official figures do not altogether bear this out. The tonnage of machine tools exported during the first four months of the current year was well below what may be regarded as the average even for the pre-war period. In money values there is a decided advance, as on the average, prices per ton are about twice the corresponding pre-war values. In any case, while prices show a fairly steady, if slight, tendency to increase, there has been a decline both in weight and total value as compared with the same period of last year and still more as compared with 1925. Even the exports of small tools show a decline. In weight, imports this year, although considerably higher than in 1925, have fallen even more markedly than exports as compared with last year, but are still about double the pre-war figures. They have very markedly increased in total value, however, being more than three times the pre-war figures. Looking only at this year's figures, ton values since the war seem to have doubled. The increase in this respect has been especially marked during the current year, for over the same period last year exports and imports on this basis were almost equal, whereas now in ton-values the machine tool imports are 50 per cent higher than the exports.

The machine tool side of mechanical engineering still compares perhaps favorably with steam engineering, apart from steam turbines and some boilers. Firms that have specialized on reciprocating engines and neglected to take up steam turbines or to transfer to the Diesel or other internal combustion type of engine, are doing poorly. The future of this type of steam engine is not promising. The shipbuilding side is in a more hopeful condition.

RUSSIAN EXPORTS

The closing of the organization responsible for most of the trading between Great Britain and Russia has had a very direct effect on the engineering industry and especially on the machine tool side. Some £10,000,000 was, it is alleged, on the point of being expended in this way, of which about £800,000 would have gone directly in machine tools. The textile machinery industry has been specially mentioned as seriously hit. But, of course, other means may be found for carrying on commerce by private contract.

A measure of misunderstandings exists in this country regarding wages and cognate matters in British engineering shops. For instance, many people imagine that piece work is the exception. As these columns have reported, a movement has been instituted for an increase in wages rates in engineering. In the course of the negotiations (not yet finished) the employers' federation presented a report showing that, even including laborers, about half the engineering workpeople are on time rates and half on payment by results—a term synonymous with piece work. The report covers 1,368 firms. Similarly, it is shown that actual weekly earnings may be considerably in excess of the standard weekly rate, and that on payment by results skilled workers in engineering obtain as an average 20 per cent more money than time workers, and yet work one hour and a half less a week.

New Haven Exhibit and Meeting Plans Take Shape

Widespread planning by manufacturers of the east to re-equip their plants on the crest of present business prosperity points to a record-breaking attendance and participation for the Seventh Annual New Haven Machine Tool Exhibition to be held at the Mason Laboratory of Mechanical Engineering, Yale University, September 6 to 9.

The program of the exhibit, which is conducted under the auspices of Yale University, the New Haven Chamber of Commerce and the New Haven Section of the American Society of Mechanical Engineers, is rapidly taking shape in the hands of the committee.

The technical program is particularly strong this year on account of the fact that the exhibition is the occasion of the first national meeting of the Machine Shop Practice Division of the American Society of Mechanical Engineers. Under the supervision of James H. Connolly of Auburn, R. I., appointed by Chairman L. C. Morrow of the Machine Shop Practice Division to handle the matter, vigorous efforts have been under way for several weeks past to shape up the program for the technical sessions. It is tentatively planned to have these sessions on the mornings of the last three days of the exhibit and to close the exhibit during the sessions so as not to detract from their value.

Some of the speakers and their titles already secured are as follows: Myron Curtis, chief engineer, Potter & Johnston Machine Co., Pawtucket, R. I. "Economics of Machine Tool Replacement;" L. C. Morrow, managing editor, *American Machinist*, "Advantages of Up-to-Date Machine Equipment;" W. R. Atwood of the chemical products division of E. I. DuPont de Nemours & Co., Parlin, N. J., "Modern Finishes for the Machine Tool Industry;" B. H. Divine of Divine Brothers Co., Utica, N. Y., "Fundamentals of Polishing;" John T. Faig, president of the Ohio Mechanics' Institute, Cincinnati, Ohio, "Foremanship Training;" John R. Shea and John L. Alden of the Western Electric Co., joint authors of paper entitled "Improvements in Copper Wire Mill Equipment;" James H. Connolly and Thomas Allen general manager and engineer, respectively, of the Standard Machinery Co., Auburn, R. I., "Rotary Swaging and Its Effect on Materials;" Robert F. Runge, vice-president, SKF Industries, Inc., "Principles of Designing Machine Tools with Anti-Friction Bearings;" and Frank Brauer, chief draftsman, Watertown Arsenal, Watertown, Mass., "Anti-friction Bearings in Ordnance Work."

Mill Supply Council In Machinery Trade

An outstanding feature of the combined convention of the American Supply and Machinery Manufacturers' Association, National Supply and Machinery Distributors' Association, and Southern Supply and Machinery Dealers' Association, held on the steamship *Noronic* on the Great Lakes cruise, June 13 to 17, was the acceptance of the idea of a "Mill Supply Council." The object of the council is to bring about closer co-operation between dealer and jobber. It will consist of five men from the National Association: E. P. Wells, the Charles H. Besly & Co.; Geo. Puchta, the Queen City Supply Co.; Herbert W. Strong, the Strong Carlisle & Hammond Co.; B. H. Ackles, the T. B. Rayl Co.; and W. J. Radcliffe, the E. A. Kinsey Co.; five men from the Southern association consisting of L. J. Larzelere, the Farquhar Machinery Co.; W. W. Doe, the Alabama Machinery and Supply Co.; D. D. Peden, the Peden Iron and Steel Co.; Alvin M. Smith, the Smith-Courtney Co.; and Wm. Kreling; and five from the American association consisting of W. C. Henning, the A. Leschen & Sons Rope Co.; D. S. Brisbin, the Columbus McKinnon Chain Co.; J. H. Williams, the J. H. Williams & Co.; F. H. Payne, the Greenfield Tap & Die Corp.; and R. B. Skinner, the Skinner Chuck Co. In fact, the whole spirit of the convention was one of closer co-operation between the three groups represented, and one of the objects of the new council will be to consider the possibility of a combined association. Other details to be considered will be a code of practice and nomenclature.

Southern Officers

Newly elected officers of the Southern association are: President, T. C. Keeling, the Nashville Machine & Supply Co.; vice-president W. W. Doe, the Alabama Machinery & Supply Co.; second vice-president, D. D. Peden, the Peden Iron & Steel Co. The executive committee comprises L. J. Larzalere, the Farquhar Machinery Co.; P. Pidgeon, the Pidgeon-Thomas Iron Co.; C. W. Beckner, the West Virginia Hardware & Supply Co.; and E. C. J. Salm, the Dixie Mill Supply Co.

The following officers were elected by the American association: President, R. B. Skinner, the Skinner Chuck Co.; vice-president, W. C. Henning, the A. Leschen & Sons Rope Co.; second vice-president, C. O. Drayton, the Drayton & Knight Co.; third vice-president, H. Armstrong, the Armstrong Bros. Tool Co.; and chairman of the executive committee, Dixon C. Williams, the Chicago Nipple Mfg. Co. The other members of the executive committee are: W. C. Allen, the Black & Decker Mfg. Co.; K. W. Atkins, the E. C. Atkins Co.; H. F. Wright, the Wright Mfg. Co., and B. F. Reuther, the Mechanical Rubber Co.

The National association elected the following officers: President, E. P. Wells, the Charles H. Besly & Co.; vice-president, H. H. Kuhn, Hardware & Supply Co., and chairman of the executive committee, E. B. Hunn, the C. S. Mersick Co.

Among some of the resolutions passed was one commending Dixon C. Williams for his active administration of the anti-trust legislative committee formed to influence Congress to modify the Sherman Act.

Freight Claim Division of A. R. A. Holds Convention

Efforts to bring about a still further reduction in claims growing out of loss and damage to freight shipments while in transit on the railroads of the United States and Canada were discussed at the thirty-sixth annual convention of the Freight Claim Division of the American Railway Association, held on June 14 at Quebec, Canada.

An address by Henry R. Grochau, of St. Paul, Minnesota, Chairman of the Division and Assistant Freight Claim Agent of the Chicago and North Western Railway, followed the opening address of Sir George Garneau, Chairman of the Canadian Battle Fields Commission. Others to speak during the convention included Judge J. C. Walsh of the Superior Court of Quebec; David Crombie, Chief Transportation Officer, Canadian National Railways; E. S. Hartman of the Lehigh Valley Railroad, and F. B. Hunt, Chief of the Loss and Damage Prevention Department, Atchison, Topeka and Santa Fe Railway, Eastern Lines.

Claims paid for loss and damage to freight shipments by the railroads of the United States and Canada in 1926 were the smallest in proportion to freight revenues for any year in the last twenty-five, according to a report submitted by the Committee on Freight Claim Prevention.

Loss and damage claims, according to the report, amounted to $38,187,315, a reduction of $584,782, or 1½ per cent compared with 1925 figures. Incidentally freight traffic in 1926 was the greatest ever reported, being more than 7 per cent over that of 1925. More than 53 million cars were loaded.

For every dollar of freight revenue 0.74 cents was spent in 1926 for loss and damage compared with 0.81 cents in 1925 and 2.78 cents in 1920. The decrease in the loss and damage bill has been due not only to the more careful handling of freight by the railroads but also to the co-operation of shippers and carriers in bringing about better packing and loading.

Prompt delivery of freight at destination was responsible for the greatest reduction in the amount of loss and damage claims. This particularly affected movements of perishable foodstuffs. In 1926, loss and damage claims growing out of delay to freight shipments amounted to $3,380,936, a decrease of $984,073 compared with 1925 claims. The improved condition of freight equipment on the railroads of the United States and Canada also resulted in a substantial reduction in 1926, compared with 1925, in the amount of loss and damage claims due to defective equipment.

Packard Builds Largest Airplane Engine

The largest airplane engine ever built, with twenty-four cylinders developing 1,250 hp., has been made by the Packard Motor Co., of Detroit. It was recently delivered to the airplane factory of the Kirkham Products Co., at Garden City, N. Y., and will be installed in the racing plane with which Lt. Alford J. Williams hopes to establish a new speed record.

The engine was designed for the United States Navy by Col. J. G. Vincent and Capt. L. M. Woolson. It weighs 1,402 lb., equal to 18 oz. per hp. The bore of the cylinders is 5⅝ in.; stroke, 5 in.; and displacement, 2,775 cu.in. It rotates at 2,700 rev. per minute.

Bureau of Standards Tests Plug Gages for Wear

A machine has been built by the Bureau of Standards for studying and testing the wear of plug gages, and the results obtained have been consistent with results obtained in practice. The wringing action commonly used while actually gaging is duplicated. The "work" or gaged specimen is a split ring, held together under fixed pressure, which is horizontally rotated while the gage is automatically moved in and out of it.

Gages are tested under conditions of metal to metal wear, and abrasive wear. For the latter a mixture of lard oil and emery is used.

Chromium plated gages were found superior, under the conditions described, to gages made of customary or special steels. Under metal to metal wear they showed about 500 per cent, and under abrasive wear about 35 per cent greater resistance to wear than the better steels.

It was also shown that file-hardness is not an indication of best wear resistance, but this does not mean that soft steels are recommended, as they are liable to dents and scratches.

Adopt Standards for Airway Marking

Increased safety in flying in the United States is the aim of a standard program for marking and lighting obstructions to air navigation just approved by the Department of Commerce, the Army Air Corps and the Bureau of Aeronautics, Navy Department.

According to provisions of the approved report all obstruction towers, such as radio masts, transmission poles, flag poles, etc., in the vicinity of airports, intermediate landing fields or civil airways, must be painted to insure maximum visibility from the air. The method followed will be to use alternate bands of white and chrome yellow, separated by black bands running horizontally about the obstructions. At night the obstructions will be marked at the top with flashing red lights, lit from sunset to sunrise.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
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NOW that Lindbergh has been welcomed and the President safely settled in South Dakota, a period of business quietude might reasonably be expected as prosperous America makes ready for the summer holidays.

But Monday, June 13th, which was "Lindbergh Day" in New York, had hardly ended when the Federal Reserve Bank announced that "brokers' loans" had risen until they were within $23,000,000 of the maximum reached in January, 1926. On this announcement the stock market had a bad break when it reopened on Tuesday morning. Most of the financial writers attributed the decline to bear selling, but this was not the case. It was the result of selling by those who had been carrying stocks on margin and decided to liquidate because they feared that an effort to prevent a further expansion of credit would be made by raising the re-discount rate, or by a resort to some other method of repression.

Then, too, it is undeniable that many of those who have bought railway stocks are disappointed by the difficulties that the Interstate Commerce Commission has thrown in the way of all the consolidations thus far proposed. The result has been a distinct weakening of confidence in a further advance from an altitude that is already high when compared with previous peaks.

On Wednesday there was some recovery from Tuesday's rather acute drop, but it is plain that speculative enthusiasm has been chilled, and its revival seems unlikely until there is a decided reduction in the amount of money that is being borrowed to carry stocks on margin.

The same statement applies to the bond market, for while it is true that "standard" bonds will be in demand as long as money is easy, it is also true that a large amount of bank credit is being used to carry bonds that are not yet "seasoned" or digested, and a change in the psychological attitude of investors may make their distribution difficult even though money continues cheap.

If the security market was an inanimate mechanism like a comptometer, it might be assumed that history would repeat itself and that a given set of conditions would always produce about the same effect. But this is not the case, for the cogs and levers in what is called the market are human beings who react differently at different times to the touch of similar events.

Today they may be optimistic, and disposed to interpret everything that happens accordingly. Tomorrow weariness may overtake them, and their lassitude or fatigue may lead them to take counsel of fear rather than hope.

WHAT'S DOING IN INDUSTRY

ALREADY the summer slump is being felt throughout the country, and single orders, mostly for replacement, dominate. Here and there exceptions stand out.

NEW ENGLAND, for instance, reports a good volume of business in May with June not far behind. The activity is largely automotive, but the equipping of new southern textile mills is keeping the manufacturers of this class of machinery busy. New York, on the other hand, is counting this month as its worst. Orders are scarce, particularly from the railroads, and the used tool market is still handicapped by recent plant auctions. Chicago, Buffalo and Philadelphia report similar dullness.

DETROIT waits expectantly for Ford's new car, and the uncertainty is reflected throughout the automotive industry. Most plants are below capacity, but one or two plants expansions are scheduled for the near future, giving hope to the tool builders. Ford has already given a fair business to Cincinnati builders. There business is reported steady, though largely in single orders mostly for replacement. Milwaukee is in the same position with considerable replacement business.

GENERAL business also begins to show a seasonal decline, the chief exception being in cotton goods. The stock market is as temperamental as the weather and fails to act as predicted.

But at the present time there are some signs that a change in sentiment is coming and the jolt which the stock market received last Tuesday has probably hastened its approach.

This view is sustained by the week's trade reports. The *Iron Age* says that "the reduction in the number as well as the size of new orders for steel during the past week has served to emphasize the midyear decline," and the composite prices for both pig iron and finished steel are fractionally lower. Distributive trade in almost every line is also smaller.

Cotton goods are, however, an exception, and the domestic consumption of raw cotton in May was the largest on record for that month. Cotton futures advanced when this became known, but they are still below the previous top, as the Texas drought has been broken and the condition of the crop elsewhere has improved.

The grain markets have also had a fitful recovery but they, too, are still below the peak of the season.

Sugar has been adversely affected by the news from Japan. The financial panic there has been allayed, but a period of depression and liquidation seems to impend. Rubber has had another sharp drop which has carried it to the lowest prices of the year. Heavy selling for Singapore and London is the explanation offered, but there are some who insist that the British intend to modify or liberalize the restriction upon exports hitherto imposed.

In its entirety the domestic trade outlook has not changed much during the week, but no one is buying far ahead, and a feeling of conservatism seems to be general. This is a guarantee of stability, although it may not presage a boom.

The figures of our foreign trade for May show an excess of merchandise exports valued at $48,000,000. Net gold imports for the month amount to $33,000,000, and this sum plus the $62,000,000 bought and held in London make a total increase of $95,000,000 in our gold supply during the month. This more than offsets the contemporary excess of exports and it is plain that our continued absorption of gold is causing some concern abroad. The English bankers are also somewhat upset because France is buying gold in London and it is evident that we will soon have to take something else than gold in payment for our exports. If we refuse to do this we will be unable to export at all.

Another contingency that is remote but serious is presaged by the menacing attitude of the Soviet government in Russia. It is manifest in the executions that appear to have been ordered in reprisal for the assassination of the Soviet minister to Poland.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

DETROIT

Industrial Detroit is carefully and watchfully marking time. Machinery dealers for some weeks past have experienced a great deal of difficulty in closing orders for equipment in any but the replacement or accidental fields. Almost all of the automobile plants are holding off, and are still running far below capacity.

The Ford Motor Co. is still guarding the plans for its new car and much of the uncertainty of the industry is due to that situation. Some large orders for specialized equipment were placed last week and a normally large number of inquiries are being received. The General Motors Truck Co. in Pontiac placed a large order for equipment last week. The Oakland and Pontiac plants are planning to increase production within the near future.

The Dodge plant is getting into production on its new six and will probably make additions to its equipment soon.

Thus far the general market in Detroit has not been good and there is no immediate prospect that it will show a material improvement.

NEW YORK

Dealers and manufacturers' agents in this market find little in the way of new business developing at the present time. Inquiries, even for single pieces, have been scarce, and the slight flurry that was noticeable last week has subsided. One fairly good list came out during the week from a contractor who is building the new Presbyterian hospital. It is more than a list for tools, as it calls for the replacing of certain equipment and the remodeling of other tools.

Buying by the railroads and large industrials has been nil, only a few stray orders for replacements being recorded. The used tool market is slow, and is still handicapped by the flood of equipment released in several recent plant auctions.

Prominent dealers state that June will fall behind the May volume, but that as the summer advances the caution that now prevails should give way to optimism, and then some long-deferred buying will take place.

CHICAGO

Practically no change is evidenced in the dull condition of the machine tool market since that last reported. Among the principal local dealers in machinery the prospects of a more active market situation developing in the near future are not regarded as encouraging. Present demand for machine tools is light.

A conspicuous exception to the general report of poor business summaries for May comes from one of the principal Chicago concerns manufacturing and dealing in machine tools and special machinery, mainly for steel and iron mills. This concern reports its total business for last month in all lines of machinery as being of greater volume than during any May for the last several years, and that, while June, thus far, has shown some decline, the demand still is satisfactory.

Railroads are gradually tapering off in their buying, practically all requirements as listed during the last three or four months being filled. A few new railroad inquiries for small lots are reported, the Burlington, Wabash and Missouri Pacific being named as in the market. Trade generally among dealers handling used tools exclusively is about on the same level as for the last two months. General industrial demand shows no improvement.

CINCINNATI

While a small number of machine tool manufacturers report a slight increase in their volume of business in the past week, the majority report that sales were about at the same level as in the previous week. Selling agents report a lull, with a slight falling off in demand.

The week's orders were well diversified and well scattered over the country, the greater part of the buying being done by small machinists and general users. Railroads made a few scattering purchases of single tools and replacements and a few similar orders came from the automotive field.

Inquiries came in freely from all sections during the week, being similar in demand to the orders. A number of these were urgent, and for this reason it is thought that quick sales will develop.

Manufacturers maintained production at its usual level and no change in volume of output is anticipated at this time.

MILWAUKEE

The local machine tool industry is entering the summer in a hopeful attitude. While business is far from active and continues to fall below a year ago, enough orders are being booked to enable most shops to maintain production at the average of previous months this year. No large lots are being sold and there are none in immediate prospect, but machine shops are doing considerable replacement to take advantage of modern, multiple purpose and high production designs for quantity work.

Conservatism, which has been the distinct feature of the market since last fall, continues to dominate purchases. Most shops are well supplied with business, but there is no inclination to extend capacity. It is interesting to note that official employment reports speak of a good demand for skilled machinists, with a supply that is hardly adequate.

The automobile industry, as a whole, is marking time in its purchase of new equipment, although the Ford development is responsible for considerable business, some of which is coming to local manufacturers of milling machines. Railroad buying remains disappointingly small, with no improvement in sight.

CLEVELAND

Business in the local machinery and machine tool market showed a decline for the first two weeks of June compared to the last two weeks of May. Orders booked were for single pieces and replacements from scattered sources. Little improvement is looked for the remainder of the month.

The only bright spot at the moment appears to be in automatic equipment. Sales showed an appreciable gain since the first of the month. A wider variety of industries is taking new machines and an equally wide variety of types also is needed. The used machinery market is dull with very little demand.

The Cleveland Board of Education has authorized contracts for tools for the Thomas Edison trade school.

NEW ENGLAND

No particular development was encountered in the machinery industry of New England in the past week, business being about normal. A slight improvement in general industrial requirements was reported. This business emanated from the automotive industry and there was a suggestion in the volume of inquiries that a fair amount of additional business is soon to be placed. The bulk of the business of the future is for replacement.

Manufacturers of textile machinery are operating on full-time schedules and optimism prevails in this branch of the industry. The development of plants in the South is giving a good volume of business.

Salesmen working in the New England territory report that in general there is a better feeling and sales resistance is less. Business so far this month is better than in June last year, and the first half of the year is expected to show improvement over the corresponding period a year ago.

PHILADELPHIA

The machinery and machine tool market continued to display weakness in the Philadelphia district this week. Except for a few inquiries for replacements, all of which have not yet developed into orders, there was no display of strength.

What the future holds was not anticipated by any leaders of the industry, who, however, pointed out that the present season usually tends toward a decline. The larger manufacturers and dealers, whose market is mostly with the railroads, see little in the present situation upon which hope for active business in the future might be placed.

Some rubber concerns have made some inquiries from Philadelphia dealers and some requests for prices from railroad companies for shop replacements tended to give a little encouragement. There is little business in sight for the next two months, reports indicate.

BUFFALO

While optimism prevails in some quarters the machine tool trade here at present is extremely quiet. Only small orders are being placed and those are not as frequent as was the case earlier in the year.

Although some feel that there will be no pick-up in business now until September that feeling is by no means unanimous. Most dealers have noted that industries that use machine tools are busy and are doing a prosperous business. This has been the case for some months and a few feel that machine tool business is bound to follow such a condition.

What has been said of the machine tool trade is also true of the electrical equipment selling except that the latter seems to be somewhat more active than the former. Conditions for the future are about the same.

Guy E. Tripp, Chairman of Westinghouse, Dies after Long Illness

Had a brilliant career in electrical and other fields

GUY EASTMAN TRIPP, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co. since 1912, died on June 14 at New York Hospital, where an operation had been performed on him. He had been ill since February.

Mr. Tripp was born in Wells, Me., April 22, 1865, the son of Alonzo K. and Abbie Yeaton Tripp. He attended the South Berwick Academy, working at the same time in a general store. When he was eighteen, he obtained clerical employment with the Eastern Railway Co. He remained there seven years and was chief clerk of the maintenance of way department when he left.

In 1890 he became storekeeper for the Thomson-Houston Electric Co., which had the contract for the electrification of the West End Railway, of Boston. As traveling auditor for the company he inspected the properties of many public utility corporations.

Finding the public utility field to his liking, he associated himself in 1897 with Stone & Webster and became vice-president of the Stone & Webster Management Association and of the Stone & Webster Engineering Corporation.

When Stone & Webster were called into consultation in the affairs of the Metropolitan Street Railway Co., of New York, in 1910, Mr. Tripp was their special representative, and was so active and direct in ascertaining the weak spots of the railway company that he was made chairman of the joint committee on reorganization.

Following the completion of this task, Mr. Tripp was elected chairman of the board of directors of the Westinghouse Electric & Manufacturing Company.

When the United States entered the World War the government found the utmost difficulty in discovering a man capable of an efficient spending program involving $16,000,000,000. Mr. Tripp finally was selected and was made chief of the production division of the ordnance department.

He entered the military service in January, 1918, with the rank of major in the Ordnance Department and within ten months had been made a brigadier general and assistant to the chief of ordnance of the U. S. Army. Upon his retirement, he received the Distinguished Service Medal for "particularly meritorious service."

Mr. Tripp continued his co-operation with the War Department in its plans for national defense, and for several years was president of the New York Post of the Army Ordnance Association. At the time of his death he was a member of the Advisory Board of the New York Ordnance District.

In 1923-24, Mr. Tripp made a journey around the world to familiarize himself with conditions in all markets. He spent several weeks in Japan, where he effected co-operative arrangements with the Mitsubishi interests and was decorated by the Emperor with the Second Class Order of the Sacred Treasure.

His articles and addresses upon superpower development attracted wide notice and many of the more important

Guy Eastman Tripp

among them have been compiled by the Knickerbocker Press as "Super-Power as an Aid to Progress." Last fall a book by Mr. Tripp, entitled "Electric Development as an Aid to Agriculture," was published.

Mr. Tripp was a director of many corporations including the several branches of the Westinghouse companies. He was a member of a large number of clubs and societies, among which were the following:

American Defense Society, Inc., American Electric Railway Association, Army Ordnance Association, Chamber of Commerce of the State of New York, Chamber of Commerce of the United States, Council on Foreign Relations, Japan Society, Merchants Association, National Electric Light Association, National Industrial Conference Board, National Inland Waterways Association, and New York Board of Trade and Transportation.

Machinery Exports Gain

Exports of industrial machinery from the United States during March amounted to $14,036,000 and represented a substantial gain over the trade of the corresponding month of 1926, as well as over February, 1927, the exports for these periods being $12,857,000 and $12,275,000, respectively, according to the industrial machinery division of the Department of Commerce. The export trade in these products has been maintained at a much higher level for the first quarter of 1927 than during the corresponding three months of 1926. The average of monthly exports for the 1927 period amounts to $13,752,793, as compared with $12,339,411 for the corresponding period of 1926 and an average of $13,061,005 for the entire year 1926.

In the metal-working group exports of engine lathes increased from $162,659 to $269,602 for the corresponding quarters of 1926 and 1927; turret lathes from $82,221 to $125,682; planers from $3,008 to $41,787; shapers and slotters from $71,702 to $130,641. Shipments of "lathes other than turret and engine," declined from $245,724 for the first three months of 1926 to $187,295 for the corresponding quarter of 1927.

Owen D. Young Heads American Delegation to International Commerce Conference at Stockholm

The world gathering of more than a thousand business men of forty-three countries will be able to suggest means for solving some of the post-war problems that still hinder the full development of international trade is the opinion expressed by Owen D. Young as he sailed for Stockholm as the head of the American delegation to the Congress of the International Chamber of Commerce, to be held June 27 to July 2. In this group were 150 prominent business men representing all phases of industrial, financial and commercial life.

Mr. Young, who was a member of the Dawes Commission, outlined what might be regarded as a new "Dawes plan" to complete the economic reconstruction of the world. He stressed his belief that the principal international problems today were economic rather than political.

He declared that international co-operation among the practical business men of the commercial nations of the world was an absolute necessity. The conference, he explained, would concentrate on efforts to create a world public opinion which, he hoped, would enable the governments to get together for the removal of trade barriers between nations.

Among the important questions the conference would discuss under this heading are the free movement of raw materials, import and export restrictions, discriminatory treatment of foreign nations, companies and capital; obstacles to transportation, international combinations, and complicated and wasteful customs procedures.

The United States Government has recognized the importance of the conference by sending twenty members of the foreign service as guests of the American delegation to furnish them with the latest information on the economic conditions of foreign countries. Leland Harrison, American Minister to Sweden, will head the Government representatives.

Personals

L. H. PRATT, formerly of the Boston office of Henry Prentiss & Co., Inc., has been transferred to the main office in New York. He will cover the New York territory as far north as Albany.

DAVID W. WOOD, former head of the Wood Tilted Turret Lathe Co., has been appointed receiver for the Crawford & McCrimmons Foundry & Machine Co., Brazil, Ind., in place of John M. Raleigh.

W. R. MITCHELL, formerly in charge of the Detroit office of the National Acme Co., Cleveland, has been elected vice-president of that company and will be located in Cleveland after July first.

VALENTINE FINA, former president and general manager of the Clum Manufacturing Co., has become vice-president and general works manager of the Milwaukee Valve Co., 139 Burrell St., Milwaukee, Wis.

T. I. SHRIVER, sales representative for Henry Prentiss & Co., Inc., of New York, has moved from Binghamton, N. Y., to Elmira, N. Y. His address there is 711 West Clinton Street.

HENRY H. KNAPP, chief accountant, Wickwire plant, Wickwire Spencer Steel Co., Inc., Buffalo, has been elected president of the Buffalo chapter, National Association of Cost Accountants.

GEORGE N. JEPPSON, works manager and a director of Norton Co., Worcester, Mass., has been elected president of the Worcester Airports, Inc. which will maintain an airport near Grafton, Mass.

GORDON L. EDWARDS has been elected treasurer of the United States Steel Corporation, New York, to succeed the late F. M. Waterman. Mr. Edwards is a member of the American Iron and Steel Institute.

THOMAS TOWNE, for several years Eastern sales manager of the Fitzsimmons Co., Youngstown, Ohio, manufacturers of cold finished steel bars and shafting, has been appointed general sales manager of the company.

G. H. HEDRICK has opened an office at 300 West Adams St., Chicago, for the Baush Machine Tool Co., Springfield, Mass. Particular attention will be paid to the application of multiple drilling of heavy beam sections.

A. H. MOORE, chairman standardizing committee, General Electric Co., Schenectady, N. Y., has announced his retirement, effective Aug. 1, following 39 years of service with the company. He will be succeeded on the standardizing committee by S. H. Blake.

THEODORE F. MERSALES resigned June 1 from the presidency of Montgomery Ward & Co., of Chicago, to become president of the Johns-Manville Corporation, New York. Mr. H. E. Manville, whom he succeeds, has been elected chairman of the board.

H. H. KELLY, formerly trade commissioner in the Paris office of the Department of Commerce, has been appointed special automotive trade commissioner for Europe. He is president of the American Automotive Club of Paris and was at one time assistant chief of the automotive division of the Department of Commerce at Washington. The new post has been created in anticipation of increased export trade in automotive products.

Obituaries

HORACE R. THURBER, for thirteen years manager of the Rochester branch of the McCormick Machinery Co., died on June 7 at the age of 77, at his Auburn home. He was for some time also affiliated with the International Harvester Co. in both Toronto, Can., and Auburn, N. Y. In 1912 he retired from active business.

WILLIAM GILMOUR, for many years known in the engine business in Montreal, died in a hospital in that city on June 12, in his 78th year. Born in Paisley, Scotland, he went to Canada fifty years ago, and for many years was connected with the Laurie Engine Co. After his retirement a few years ago, he devoted himself to studies in the perfection of steel hardening processes.

JACOB ASSEL, SR., for 18 years master mechanic of the Bassick Co., Bridgeport, Conn., died June 11 at his home, 656 Warren Street, that city. Mr. Assel was born in Germany 63 years ago. While with the Bassick Co., Mr. Assel was in charge of the experimental mechanical work of the plant and during that time has perfected several processes and devices now used by the company.

Business Items

The Newark Steel Drum Co. has removed its plant to Linden, N. J.

The William Ganschow Co. announces the appointment of the Schreer Bros., 2303 Holmes St., Kansas City, Mo., as their exclusive representatives in the states of Kansas and Oklahoma.

The National Bearing Metals Corporation, 30 Church Street, New York, has been organized to manufacture brass and bronze bearings, composition castings, journal bearings and other products.

The Plimpton Lift-Truck Corporation has moved into its new building on Elm Court, Stamford, Conn. The building is of mill construction, two floors 40x80 ft., with one-story wing 40x40 ft., and is equipped with modern facilities for handling the work.

The Chrysler Corporation, East Jefferson St., Detroit, Mich., has given over a portion of its plant for parts manufacture and assembling of motor-boat engines, to be known as the Chrysler Imperial marine engine.

The St. Louis Spring Co., 3135 Washington Blvd., St. Louis, Mo., has been organized to manufacture metal springs and kindred metal products. The company has its own plant at St. Louis and branches at San Antonio, Tex., and Denver, Colorado.

The Titgen-Eastwood Co., Luzerne and D Sts., Philadelphia, Pa., has purchased all the patterns and drawings of the J. W. Paxson Co., and will continue the general line of foundry equipment formerly made by the Paxson Company.

The Belle City Electric Co., Racine, Wis., has been incorporated by the principals, William Driven and Lawrence J. Bieneman, to manufacture labor-saving devices and appliances for use with fractional-horsepower motors. A factory is being established at 1533 Pratt Ave., Racine.

The new work shops of the Quebec Power Co., which are now being erected at Limoilou, Quebec, will be handed over to the company in a few weeks. The shops will be used not only for repairing of the rolling material of the company, but also for the construction of new cars.

The American Malleable Co., Lancester, N. Y., has been sold and reorganized under the name of the Lancaster Malleable & Steel Corporation. The plant, which has been idle for five months, will be put into immediate operation. W. B. Symmes is president of the new corporation.

J. F. Shouse & Co., 1197 Starks Bldg., Louisville, Ky., has been appointed sales representatives of the Whiting Corporation, of Harvey, Ill., for its complete line of cranes, foundry equipment and railroad specialties in Kentucky and the southern part of Indiana.

The Penn-Monaca Steel Products Co., 1746 Pennsylvania Ave., Monaca, Pa., will continue the manufacture of a one-man facing table and a general line of structural work formerly carried on by the Keystone Automatic Appliance Co. of Rochester, Pa. The new company is the result of reorganization.

The Rotor Air Tool Co., 5905 Carnegie Ave., Cleveland, Ohio, has purchased the pneumatic tool division of the Warner & Swasey Co., Cleveland. Although a distinct unit, the new company will be closely associated with the Warner & Swasey Co. in that H. P. Bailey will be its president. He will continue to maintain his position with Warner & Swasey.

The Corinth Machinery Co., of Corinth, Miss., manufacturers of machinery, has purchased the plant and properties of the Southern Engine & Boiler Works, of Jackson, Miss., it is announced by H. E. Ray, an official of the former concern. The equipment, it is stated, will be moved to the company's plant at Corinth and the two firms merged.

The Hadfield-Penfield Steel Co. plants at Bucyrus, Mansfield and Willoughby, Ohio, appraised at $2,400,000, were sold to the National Security Co. of New York for $510,000 to satisfy a mortgage claim of the United States for $1,761,000 advanced during the World War for manufacture of shells and munitions. It is probable that the plant, which employs about 600 men, will continue in operation.

The Harry Schneider Co., 1225 Broadway, New York, has been appointed exclusive sales agent in the United States by the Compagnie Generale de L'Industrie, Brussels, Belgium, a combination of twenty-four manufacturers. Included are iron and steel products, steel rails, building materials, window and plate glass, lead sheets, aluminum sheets, lead pipes and other nonferrous metals, paints and lighting fixtures.

The Remington Service Machines, Inc., 25 Broadway, New York, has been organized as a subsidiary of the Remington Arms Co. to take over and expand the plant and business of the Universal Sales Machine Co., 104 Portland St., Boston, Mass., manufacturers of bending machines and parts. John B. Smiley, head of the Remington Arms Co., will be president of the new company. Arthur H. DuGrenier, previously president of the Universal company, will continue with the new organization.

The Foos Engine Co. is the reorganized name of the Foos Gas Engine Co., of Springfield, Ohio. J. F. Baker has been elected president and M. E. Baker secretary-treasurer, while Ray C. Burrus has been appointed sales manager. W. W. Schettler, chief engineer and G. F. Nolton, mechanical engineer. A new factory branch is to be established at Tulsa, Okla., and the Pacific Coast representative, Garvey & Palmer, Inc., now has offices in Los Angeles, San Francisco and Seattle. The company will continue the manufacture of internal combustion engines.

Forthcoming Meetings

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Builders' Exposition. First annual machine tool exposition, conducted by the National Machine Tool Builders' Association, at the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, chairman of the exposition committee. Roberts Everett, manager of the exposition, 225 West 34th St., New York. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Building, Cincinnati, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

BUYING of steel for use in the railway, automotive and other important industries continues to sag. Fairly active demand from miscellaneous sources prevails in the market for sheets (black and galvanized), strips, bars and reinforcing material. Prices of the last mentioned items together with those on rivets are firmer than a week ago at principal points. Non-ferrous metal scrap, as a group, has finally turned upward after a prolonged decline. Pig-iron and non-ferrous metals prices tend downward. Steel structurals quotations are practically at levels of a year ago. Red and white lead, f.o.b. New York, declined 1½c. per lb., effective June 16.

(All prices as of June 17)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$22.19
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	27.17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	23.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.25	3.50	3.25	3.89
No. 12	2.30	3.55	3.30	3.94
No. 14	2.35	3.60	3.35	3.99
No. 16	2.45	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.90	3.75	3.75	4.00
No. 22	3.05	3.90	3.90	4.15
No. 24	3.10	3.95	3.95	4.20
No. 26	3.20	4.05	4.05	4.30
No. 28	3.35	4.20	4.20	4.45
Galvanized				
No. 10	3.15	4.10	3.95	4.25
Nos. 12 to 14	3.25	4.20	4.05	4.35
No. 16	3.35	4.30	4.15	4.45
No. 18	3.50	4.45	4.30	4.60
No. 20	3.65	4.60	4.45	4.75
No. 22	3.70	4.65	4.50	4.80
No. 24	3.85	4.80	4.65	4.95
No. 26	4.05	5.05	4.90	5.20
No 28	4.30	5.30	5.15	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 56-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	Thickness — B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	¾	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.75 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic, up to carlots, New York			13.87½
Tin, pigs, 5-ton lots, New York			69.37½
Lead, pigs, up to carlots, E. St. Louis	6.15	New York	7.00
Zinc, slabs, up to carlots, E. St. Louis	6.25	New York	7.12½

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	15.50	....	15.00
Copper sheets, base	21.50	21.50	21.50
Copper wire, base	18.25	18.25	14.75
Copper bars, base	21.12½	21.25	21.12½
Copper tubing, base	23.50	24.25	23.50
Brass sheets, high, base	17.75	17.75	17.75
Brass tubing, high, base	22.62½	22.62½	22.62½
Brass rods, high, base	15.50	15.62½	15.50
Brass wire, high, base	18.25	18.25	18.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	11 00	11 30	10 11
Solder (½ and ½), (case lots)	41.00	42 00	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	86.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	13.00

Nickel, f.o.b. refinery, cents per lb.:
Ingots..... 35.00 Electrolytic.. 39 00 Shot.....36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11 25 @11.50	10.50	9.75@10.25
Copper, heavy, and wire	10 50 @11.00	10.50	9.00@ 9.50
Copper, light, and bottoms	9 25 @ 9.75	9.00	8.00@ 8 50
Heavy lead	5 00 @ 5.50	5.25	4.50@ 5 00
Tea lead	4.25 @ 4.50	3.25	3 00@ 3.50
Brass, heavy, yellow	7 00 @ 7.50	6.75	6.50@ 7.00
Brass, heavy, red	8.75 @ 9.00	9.25	8.50@ 9.00
Brass, light	5.00 @ 5.50	6.00	5.50@ 6.00
No. 1 yellow rod turnings	7.50 @ 7 75	7.00	6.50@ 7.00
Zinc	3.75 @ 4 00	3.00	2.50@ 3 00

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.75@8.00	7 00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 10@0. 13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.15½	36.00 per M	.15
Sal soda, per lb	02½	.02	02¾
Roll sulphur, per lb	02¾	.03½	04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	89½	.99	.90
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	65	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	33	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.155	.1587½	.1662½
Solder (½ and ½)	per lb.	.41	.41	.3675
Cotton waste, white	per lb.	.10@13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.65	.55	.55
Machine oil	per gal.	.33	.33	.35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1 29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		75	75
Coke, prompt furnace, per net ton		Connellsville,	3.00@3.25
Coke, prompt foundry, per net ton		Connellsville,	4.25@4.75
White lead, dry or in oil,	100 lb. kegs	New York,	13.75
Red lead, dry	100 lb. kegs	New York,	13.75
Red lead, in oil	100 lb. kegs	New York,	15 25

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Broken Kegs or Cases	Full Kegs or Cases
Machine bolts, square heads and nuts:		
Up to ¾ x 6-in	50%	50–10%
Larger up to 1 x 30-in	45%	50%
1¼ and 1½ in. dia	30%	35%
Carriage bolts:		
Up to ½ x 6-in	50–10%	.....
Larger sizes	50%	.....
Coach and lag screws:		
Up to ½ x 6-in	50–10%	.....
Larger sizes	50%	.....
Tap bolts, hexagonal heads	45%	.....
Nuts:		
Hot pressed, square and hexagonal, blank or tapped	45%	50–10%
Cold punched, square and hexagonal, blank or tapped	45%	50–10%
Semi-finished, hexagonal, tapped, in packages	40%	.....
Case hardened, hexagonal, tapped, in packages	30%	.....
Washers: Deduct from list, per 100 lb.	$1.50	$3.50
Rivets, button and cone head:		
Small, including 7/16-in. dia	.....	50–10%
Large (base) per 100 lb	$6.50	$5.00

EXTRA per 100 lb. on rivets, for ½-in. dia., 35c.; ¾-in., 15c.; 1-in., 5c.; length 1-in. and shorter, 25c.; longer than 1-in. up to and including 1¼-in., 15c.; longer than 5-in., 25c.; standard countersunk head, 25c.

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Lynn—H. Weinstein, 18 Whittier St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $50,000.

Mich., Detroit—Industrial Scrap Iron & Metal Co., 2637 West Fort St.—heavy shear for scrap use.

Mich., Detroit—A. Laitner & Sons, 2000 Brooklyn Ave., (brush manufacturers) light power press.

O., Cleveland—The American Brass Mfg. Co., 1525 East 49th St., J. Arth, Pres.—6 buffing and polishing machines for proposed 2 story, 20 x 70 ft. addition to factory. Estimated cost $40,000.

O., Cleveland—Modern Mfg. Co., 4734 Hough Ave., W. F. Bach, Secy. and Treas. (heating and plumbing supplies)—lathe, punch press, drill press and screw machine for proposed 1 and 2 story, 65 x 120 ft. factory. Estimated cost $50,000.

O., Cleveland—Valley Machine Co., 2310 Oakhill Ave.—one 30 in. x 30 ft. lathe.

O., Columbus—Lattimer-Stevens Co., 72 Yale Oak St., E. M. Stevens, V. Pres. (meters and metal products)—6 molding machines for proposed new plant on Marion Rd.

O., Portsmouth—Scioto County Motor Co., 1022 Gallia St., C. A. Sennett, Pres.—electric drill, heavy press and other equipment for service station.

Okla., Bristow—Arnold Iron & Steel Mills Inc., J. W. Arnold—machinery and equipment for the manufacture of steel bars, wagon tires, railroad spikes, etc. Estimated cost $75,000.

Pa., Glassport—Copperweld Steel Co.—two 5 ton overhead electric cranes.

Tex., Rock Springs—E. Miller, machinery and equipment for proposed 1 story, 90x100 ft. repair garage. Estimated cost $40,000.

Ont., Brockville—E. J. Phillips Electrical Works Ltd., 5795 de Gaspe St., Montreal, Que.—machinery and equipment for proposed new wire manufacturing plant, here.

Que., Montreal—P. Joran, 3670 St. Andre St.—complete equipment for proposed garage and repair shop.

Opportunities for Future Business

Ala., Birmingham—The Gulf States Steel Co., B.-M. Bldg., plans extensions and improvements to plant including ore and blast furnaces, etc. Estimated cost $3,000,000.

Conn., Hartford—White Motor Co., B. M. Holden, 750 Main St., will soon award contract for the construction of a 1 story, 150 x 150 ft. service station on Maple Ave. Estimated cost $100,000. Private plans. Noted Apr. 28.

Ill., Chicago—Ketler-Elliott Erection Co., 3127 South California Ave., awarded contract for the construction of a 2 story, 80x90 ft. repair shop, etc. at 3101-3119 South California Ave. Estimated cost $40,000.

Ill., Chicago—B. E. Mittleman, 11 South La Salle St., will soon receive bids for the construction of a 3 story, 100 x 230 ft. garage at 2425-2443 North Clark St. Estimated cost $300,000. M. O. Nathan, 123 West Madison St., Archt.

Ill., Chicago — North West Side Iron Works, 1518 North Western Ave., will soon receive bids for the construction of a 1 and 2 story, 160x162 ft. steel fabricating shop at 4200 Diversey Blvd. Estimated cost $300,000. H. Miller, 5 North La Salle St., Archt.

Ill., Chicago — Sternberg Mfg. Co., 4510 Addison St., ornamental iron work, will build a 1 story, 30x110 ft. addition to plant.

Ill., Chicago — A. E. Storbel, 53 West Jackson Blvd., Archt., is receiving bids for the construction of a 1 story, 25x112 ft. addition to machine shop for W. Eberhardt & E. M. Steinle, 1443 West Harrison St. Estimated cost $15,000.

Ill., Silvis—Chicago, Rock Island & Pacific Ry. Co., La Salle Sa. Station, Chicago, awarded contract for the construction of 1 story additions to locomotive shops here. Estimated cost $50,000. C. A. Morse, Ch. Engr.

Ind., Anderson—Maring Wire Co., Muskegon, Mich., will soon award contract for the construction of a plant at 31st and Noble Sts. here. Estimated cost $40,000.

Ky., Louisville—Bade-Cummings Mfg. Co., 3401 Jewel St., manufacture of auto and small furniture hardware, awarded contract for the construction of a 1 story, 50x350 ft. factory at 31st and Jewel Sts. Estimated cost $65,000.

Ky., Louisville—Bessire Realty Co., 13th and Main Sts., manufacturers of bakers supplies, awarded contract for the construction of a 1 story, 200 x 200 ft. factory. Estimated cost $100,000.

Mass., Arlington (Boston P. O.)—Bd. of Public Works, awarded contract for the construction of a 1 story, 70 x 140 ft. garage and repair shop at Hobbs Court. Noted June 16.

Mass., Chelsea (Boston P. O.)—Union Motor Sales Co., 40 Fourth St., is having contract for the construction of a 1 story, and 2 story repair and service garage. Estimated cost $40,000. Eisenberg & Feer, 46 Cornhill, Boston, Archts.

Mass., Norfolk Downs (Boston P. O.)—J. P. Granahan, 28 Lunt St., Quincy, plans the construction 1 story, 80 x 100 ft. repair and service garage on Safford St., here. Estimated cost $45,000. Architect not selected.

Mass., Somerville (Boston P. O.)—Boston & Maine R.R., Boston, awarded contract for the construction of a 1 story, 30x125, 20x30 and 20x40 ft. mill building at Yard 8 N.E. Asylum Hill here. Estimated cost $40,000. W. J. Backes, Ch. Engr.

Mass., Wellesley (Boston P. O.)—Wellesley Colonial Garage Inc., c/o Blackall, Clapp & Whittemore, 31 West St., Boston, Archts., awarded contract for the construction of a 2 story, 105x140 ft. repair and service garage at Linden and Central Sts. Noted June 2.

Mich., Pontiac—Yellow Truck & Coach Mfg. Co., General Motors Bldg., Detroit, plans the construction of a factory here. Estimated cost $1,000,000. Architect not announced.

Mo., St. Louis—Coronado Hotel, P. Bradshaw, Pres., Spring and Lindell Aves., awarded contract for the construction of a 3 story, 90x100 ft. garage and service station at Westminster St. and Spring Ave. Estimated cost $85,000.

N. J., Camden—Public Service Electric & Gas Co., 418 Federal St., will soon award contract for the construction of a 1 story, 140 x 155 ft. garage. Estimated cost $150,000. Public Service Production Co., Duffield Ave., Newark, Archt.

N. Y., Brooklyn—Brooklyn & Queens Co., 1576 Bushwick Ave., manufacturers of wire screens, will soon receive bids for the construction of a 2 story, 50x100 ft. factory. Estimated cost $60,000. Lama & Proskauer, 391 Fulton St., Archts.

N. Y., Brooklyn—F. Cohn, 745 65th St., manufacturers of metal toys, will build a 2 story, 50x100 ft. plant. Estimated cost $65,000. Salvati & Le Quorhik, 369 Fulton St., Archts.

O., Cleveland—Case School of Applied Science, C. S. Howe, Pres., awarded contract for the construction of 3 story, 60 x 150 ft. mechanic and hydraulic laboratory buildings on Euclid Ave. Estimated cost $150,000.

O., Cleveland—The Cleveland Chain & Mfg. Co., L. D. Cull, Secy. and Treas., Stop 3, Bedford Rd., awarded contract for the construction of a 2 story, 50 x 100 ft. addition to factory. Estimated cost $50,000.

O., Cleveland—The Cleveland Railway Co., Hanna Bldg., plans the construction of a 3 story garage, etc. at East 10th St. and Central Ave. Estimated cost $210,000. L. D. Bale, c/o owner, Archt.

O., Cleveland—P. Halliday, 10510 Euclid Ave., had plans prepared for the construction of a 1 story, 85 x 200 ft. metal stamping factory on Richmond Ave. Estimated cost $60,000. Carter Richards Co., Engineers Bldg., Archts.

O., Cleveland—The Industrial Fibre Co., H. Rivitz, Pres., West 98th St., awarded contract for the construction of a 41 x 227 ft. machine shop, etc. Estimated cost $75,000.

O., Cleveland—The Ohio Boxboard Co., C. W. Hackett, Secy., 1390 East 30th St., will soon award contract for the construction of a 2 story, 62 x 120 ft. addition to factory. Estimated cost $60,000. Christian, Schwarzenberg & Gaede, 1900 Euclid Bldg., Archt.

O., Cleveland—The Ohio Forge Co., 2955 East 92nd St., awarded contract for the construction of a 1 story, 50 x 80 ft. factory. Estimated cost $40,000.

O., Cleveland—James Schuld, 3006 St. Clair Ave., wagon manufacturer, awarded contract for the construction of a 38 x 94 ft. factory at 1717 East 45th St. Estimated cost $40,000. Private plans.

O., Columbus—Schmitter Bros., 1738 Myrtle Ave., will build a 1 story, 38 x 100 ft. repair and service garage. Estimated cost $35,000. Private plans.

O., Newton Falls—All In One Motor Co., manufacturers of engines for trucks, autos, boats, etc. plans the construction of a 50x100 ft. factory on Arlington Rd. Estimated cost $50,000.

Pa., Philadelphia—United Gas Improvement Contracting Co., Broad and Arch Sts., will build a 6 story, 61 x 121 and 61 x 439 ft. warehouse and shops at Ninth and Berks Sts., also a 1 story, 80 x 320 ft. garage at Montgomery and Berks Sts. Estimated total cost $797,000. Perry, Shaw & Hepburn, 177 Station St., Boston, Mass., Archts.

Tex., Corpus Christi—Alamo Iron Works, E. Holmgreen, 130 Santa Clara St., San Antonio, has acquired a site and plans the construction of a 2 story, 127 x 300 ft., steel fabricating plant here. Estimated cost including equipment $150,000. Private plans.

Tex., Edinburg — Pacific Fruit Express Co., 65 Market St., San Francisco, Calif., will receive bids until June 28 for the construction of an artificial ice plant including blacksmith shop, etc. Estimated cost $250,000. Private plans.

Tex., Houston—Tracker Building & Lumber Co., will build a planing mill. Estimated cost $40,000. Private plans.

Tex., San Antonio—The Acme Wire & Iron Works, 1601 North Laredo St., has acquired a site and plans the construction of a 1 story, 65 x 125 ft. factory for the manufacture of wire and similar products.

Ont., Toronto—Dundas Motor Sales Ltd, 2295 Dundas St. W., plans the construction of a 4 story garage. Estimated cost $150,000. Catto & Catto, 200 Bay St., Archts.